RAILROAD GAZETTE

FRIDAY, OCT. 23.

CONTENTS.

Contributions.

Heavier and Harder Rails.

19 Great George St., Westminster, S. W., London, Oct. 7, 1891.

To the Editor of the Railroad Gazette:

Pressure of business has prevented my earlier reply to your letter of the 7th of September. After seeing the editorial article in your last issue to hand, [*Railroad Gazette*, Sept. 25, editorial note on the tendency in rail practice, in weight, carbon and section.] I shall not delay any longer replying thereto, as your American practice seems to differ widely from ours in Europe.

Now as to heavier rails in Europe. Since my first design of the 100-lb. rail in 1886, and the paper read thereon before the Institution of Civil Engineers, the necessity of adapting the road to the rolling stock has gradually become an acknowledged fact among engineers generally. The weight of engines constantly increasing, heavier trains, greater speed, an increased number of railway accidents on account of too weak a track, all this has made the public put pressure on the railway companies to correct an error which has already existed too long. Unfortunately changing the rail on a road is a long process, and many of us will not have the benefit of traveling upon the better road. However, a beginning has been made, and, at all events, we can look to the traveling safety of our children. In my last paper on rails, read before the Institution of Mechanical Engineers in July, 1890 [*Railroad Gazette*, Aug. 15 and 29, 1890.], you will find, in Table No. 3, the increase of weight in rails which has taken place on all the French railways to be from 60 up to 90 lbs. per yard, and even as high as 94 on the Paris-Lyons-Méditerranée; but the Belgian State take the palm with their 105-lb. rails, and also their quick progress in laying them. They have laid 50,000 tons since 1887, and are laying about 18,000 tons yearly, and will have the whole of their system of main lines completely laid with the Goliath rail in 1897. In Italy they have increased the weight from 72 to 84 lbs., and in Austria they have also this year increased the weight of their rails to 90 lbs. per yard. In Germany there has been but very little progress made, which is all the more to be regretted, as nowhere is a heavier rail more wanted than in Germany.

Now as to England. There roads are perfection. They are laid with 85 to 90-lb. bull-headed rails, in chairs weighing 50 lbs. each, and, as you know, my aim has been to reach this perfection with a heavy flange rail, so as to have no necessity for an exchange of system of track, which is almost impracticable. With the view of a trial, a special experiment is being made on the Furness Railway, near Barrow, where a couple of miles is laid with my Goliath rail and base-plate on one line of the track, and the ordinary English rail on the other—all for heavy traffic (see discussion on my last paper). So far one shows as good results as the other. But there is a longer experience than that. In the Penge tunnel, a mile long, of the London, Chatham & Dover, a flange rail, 87½ lbs. per yard, has been laid these twenty years with the ordinary English track outside the tunnel, and the locomotive engineer informs me that one track is as good as the other. In the Severn tunnel a U or bridge rail, of 120 lbs. weight per yard, has just been laid, made by the Dowlais Steel Co. In the St. Clair tunnel my Goliath rail is laid, being the first example on your side I believe of a 100-lb. rail, with the exception of the Chignecto Ship Railway which is laid with 110-lb. flange rails. You have several roads coming very near Goliath weight, and it is high time taking into consideration the increased weight of engines, for instance 72 tons on the Canadian Pacific; and further, with the late marvelous performance as stated in your paper of a mile a minute for more than seven hours, it is highly desirable, for the safety of your visitors as well as your own good people going to the World's Fair. We have now on the St. Gothard an increase in the weight of engines to 84 tons, and the road is laid with 80-lb. rails, but is being increased to 90-lbs.

You have the advantage in America of close sleepers, 2 ft. apart centre to centre, and here in England we have 2 ft. 6 in. but on the Continent it is 3 ft. to 3 ft. 6 in. An immediate relief to strengthen our weak track is to put the sleepers closer, a process which can be carried out in a few years, while the strengthening of the rails will take 10 to 20 years and with no general effect, as one part of the line strengthened does not affect the other. This increase of sleepers is certainly not true economy, for in Europe wood is dear and metal cheap, comparatively, but it is the only cure available for immediate results. A change from fine ballast to stone is also applied where it is possible to obtain it. Thus you may take it for granted that in Europe the strengthening of the track has made great progress during the last few years, by using heavier rails, closer sleepers, and better ballast.

Now, as to hardness of rails. Heavier and harder has always been my theory ever since the time when I first designed the Goliath rail, and it has been followed up; but by no means as fast as you are going, judging from your last leader. We seem evidently to value safety more than you do. In England, with the light rolling stock upon heavy rails, no rails are crushed when even of medium hardness, so there has been no necessity for extreme hardness, and about .40% of carbon has been the average for many years, and is still so. In France the rail steel is harder, as you will see from my last paper on "Steel Rails Considered Chemically and Mechanically." In Germany the amount of carbon is low, owing to the greater quantity of phosphorus.

Although I have carried out chemical tests for many years in my inspection work, I have hesitated to have it made a stipulation in the specification, but have lately found it necessary to make such a clause. The following is extracted from the same: "(The steel) must contain .30 to .45 per cent. of carbon, according to the amount of phosphorus present, which must in no case exceed 0.08 per cent., and the manufacturer must make frequent chemical analyses of borings taken from the rail by the inspector, to show that this composition is being closely worked to. The inspecting engineer shall be at liberty to check these analyses, as also to test the steel by forging, tempering, bending, tensile strain or otherwise, to satisfy himself that the proper material is being used."

The amount of phosphorus present should regulate the carbon, and it is a fact that rails which contain a high amount of phosphorus such as .10, .12 and even .15 per cent., with a low amount of carbon, say .20 to .25 per cent., can be made when they are rolled as great heat, and cooled very gradually to stand a most rigorous drop test, thus complying with the terms of the specification. But it is a curious phenomenon that these rails get gradually brittle by use in the track on account of the cold hammering of the wheels, and will break, particularly in the winter, before they are half worn. The last severe winter has proved this in several countries, and has shown the superiority of caroon hardened steel against phosphorous hardened for rails. We have, I should say, only half the amount of phosphorus in English rail steel that you have in the states, and I am, therefore, inclined to think that you are running a great risk in over-dosing your rails with carbon up to .50 and .60 per cent. Your quick rolling bringing out the metal quite hot and cooling it gradually may prevent fractures at first, but, if your experience is going to be the same as ours, brittleness will come by wear, and cause fractures before the rails are half worn out, which would not be an economy in the end.

Now as to section. American sections of flange rails are generally wider and thinner than the European ones, which will be another additional cause of fracture. The wider and thinner heads would avoid the flattening of rail ends, I should think, without having extreme hardness, and in this modification of rail sections, as in many other respects, the American Society's Committee have done good work, but it cannot be expected that it should bear good fruit in a year or two, as it is a slow process to change rail sections on existing tracks, but nevertheless it cannot fail to be of immense value in the future. It is much to be regretted that in Europe the many different countries have not adopted a standard section. We are thus far behind you in this respect.

In conclusion you may take it that we are progressing with heavier and harder rails, particularly heavier, and feel our way for corresponding hardness with due attention to safety. We shall follow your progress with the greatest interest, particularly with the view to the hardness which you have stated, hoping that you will not sacrifice safety for economy.

C. P. Sandberg.

New York Rapid Transit and the Worthen Tunnel.

To the Editor of the Railroad Gazette:

The problem of rapid transit for New York City is so important, and its intricacy is so apt to be increased by measures hastily adopted that the present commission appointed to report upon a plan to facilitate it does well not to allow itself to be hurried in its action. The city could better afford to wait a year longer, even, than to have a plan settled upon which, when executed, would prove but another obstacle to the adoption of a proper plan. What is required is something which is capable of being developed into a correct system. The present condition of the streets, both on the surface and beneath the pavement, is ample confirmation of this statement.

The elevated railroads afforded relief for a time, and an increase of them would continue to do so, if we consider the convenience of the traveling public alone. In every other respect they are only tolerable because we have not tried any other method. It may be found now that the system is capable of improvement, by adding a second deck to those we now have and suppressing some of the most objectionable nuisances pertaining to them, but an increase of their number which requires the sacrifice of more avenues should not be considered excepting as a last resort. There may, possibly, be one exception, to this viz.: If the New York Central & Hudson River could be prevailed upon to remove the Grand Central Station to the north of the Harlem River, extend its present line to a point as far south as the City Hall and then erect an elevated line above its present tracks, a great addition would be gained to transit facilities without corresponding damage.

But if instead of constructing the elevated roads, in the first place, a well devised system of tunnels, just under the pavements, and which provided abundant subways for pipes, wires, sewers, etc., similar, say, to the arcade plan, which could have been extended as occasion required, had been resorted to, it is not likely the elevated roads would have been built. But they were built first, and will probably remain a powerful competitor to whatever plan may be attempted.

In the selection of Broadway for one of its principal routes, the commission has, doubtless, acted wisely, as its object is to demonstrate the advantages of an underground system over the elevated. The street follows, generally, the ridge or backbone of the island, and in connection with other streets extends more directly than any other from the Battery to Spuyten Duyvil. It intersects more avenues than any other street lying lengthwise of the island. It is, naturally, for a great portion of its length, the most popular route for all sorts of travel. This last condition makes it decidedly objectionable to construct an elevated road on it, but makes it all the more desirable to increase its facilities for rapid travel.

There is no known method of accomplishing this on the surface, consequently it must be done underneath. This is also favored by the generally high elevation of the street. Unfortunately, the street has been adopted as a pipe and subway depot to a very confusing extent; but from a sort of natural selection these have been laid as near the surface as frost would permit, and there are comparitavely few sewers. The torn-up condition of Broadway, during this season, precludes the probability that any further general disturbance of the surface would be permitted for some years to come. The tunnel must then go below the obstructions. Then how far below?

There has been considerable discussion of a deep tunnel system, known among its advocates as the Greathead system. This proposes driving a tunnel at a considerable depth, so as to be below all foundations, and use elevators to communicate between it and the surface. Probably such tunnels could be driven by means known to our engineers and which are public property. What advantage such a system would have over one near the surface and accessible by stairs is hard to conceive, unless that it can be driven in almost any direction with equal facility and that the cost of right of way would be light. Whatever might be saved in those respects would doubtless be more than offset by greater cost of construction and subsequent operation. Then each track being in a separate tunnel at such a depth with no communication with the surface, excepting by elevators, would not be inviting. This feeling may apply only to vivid imaginations. But there is little doubt that the majority of people are sufficiently gifted that way to make them seek almost any other means of travel rather than to submit to such conditions. There may be no good reason why, if any reputable company desires to buy the land necessary for elevator stations, and bind itself to execute its work in a substantial manner, it should not be permitted to spend its own money on the experiment; but it would certainly be a great blunder if the commission were to report in favor of such a scheme.

The tunnel should undoubtedly be as near the surface as the before mentioned obstructions will permit. The plan which best meets this requirement is that of Mr. W. E. Worthen, Chief Engineer of the Commission. This plan proposes, as far as possible, to place all the tracks on one level, and that as high as practicable without disturbing pipes, etc. This plan appears to possess the following advantages:

1. It is not so deep that it cannot readily be reached by stairs.

2. All the tracks are in one broad tunnel, separated only by a single row of columns, thus permitting the passengers some chance to escape in the event of a collision, of better lighting and ventilation, and it would be in every way a pleasanter place to ride through than a single narrow tunnel. It also admits of establishing cross-over tracks.

3. The nearness to the surface and numerous stairways render ventilation easier; then, as one considerable

part of the line would be on an elevated track over which all cars would pass each trip, they would be better aired than were they to remain under ground all the time.

4. It lessens the expense of protecting the building foundations on each side.

5. It would permit of being changed to the arcade plan at some future date should that be desirable.

Compared with the elevated roads:

1. It would leave the surface unobstructed and open.

2. The tunnel portion would not be interrupted by fires along its route nor by snow storms.

3. The question of comparative popularity appears to admit of considerable debate; is, in fact, the main one and refers entirely to the passenger. If he is a visitor, who wants to see all he can of the city, he would take the elevated, but he might wish to try the tunnel itself. Residents, when once seated in either, might find that they liked riding on the elevated best.

In both cases there are stairs, which, for convenience of discussion, we may assume to average about the same in height. Most people would rather descend stairs than ascend them. They will naturally prefer descending to ascending to reach a train, in spite of the fact that they must ascend to leave it, as it is a choice of immediate evils. More especially would this be the case with a passenger hurrying to catch the first train, though he may be in no particular hurry otherwise.

Finally, it is unquestionable that many more people find themselves on Broadway than on any other street, and with such nothing but the question of landing at a point nearest to their destination would cause them to leave it or go to the elevated train in preference to a well arranged tunnel.

Now for a few remarks upon the criticisms of Messrs. Chanute and Cooper regarding the method of excavation proposed by the Worthen plan. According to the synopsis of their report as published, Mr. Chanute says:

"The weakest point about this plan is the method proposed by Mr. Worthen for excavation. In clay or firm soil this has given good results, but it is inappropriate to sand as fine as is known to be frequently found on this section. There would be danger of disaster. There would be sure to be wet sections from leaky pipes or from pipes broken during excavation. The fine sand would run away like water from under the temporary posts and the whole street, as well as some adjoining buildings, might cave in. No provision is made for side thrust."

Mr. Cooper makes a somewhat similar criticism as to insecurity, and says the method does not admit of properly protecting the metal roof from the corroding liquids which saturate the soil. He suggests some modification of the Beach shield as more suitable for the purpose.

Before answering the objections, it is proper to state that the time devoted to preparing these plans was too short to attempt anything more than to show a general arrangement of the principal parts of the device. That was supposed to be all that was required. It was expressly stated that the device as shown, supposed sufficient retaining walls on each side. It was also understood that it was for use only in cases where the bottom of the excavation did not extend low enough to cause trouble from water.

The working out of details, to meet special cases, belongs to actual construction. As to a case where there are no side walls, a multiplication of the same device would easily be adapted to take the side thrust. The main point was to have separate needle pieces, each capable of being independently thrust forward and having them of sufficient length to allow of any necessary slope of earth in front to prevent the material ahead from caving in, instead of driving one immense shield bodily forward with sufficient force to overcome all friction, penetrate the material, and continually sustain the pressure of the vertical wall of earth of the whole front. It is easy to arrange the needle pieces so that not the very finest of dry sand would sift through between them and very little water even.

The temporary posts would require sufficient spread of base to secure them from settlement, according to the character of the material; plank over the whole bottom of the heading, if required. Then the work of putting in the permanent foundations would follow as rapidly as possible. If a water pipe was leaking so badly as to give serious trouble, it would require to be attended to, and should be. If a water main bursts at any time, it is a very damaging occurrence, but the slight settlement required by the apparatus in making the excavation would not break it.

As to Mr. Cooper's objection regarding the protection of the metal from corrosion, the apparatus in question is adapted to provision for covering the metal roofing with any desired thickness of protecting material, as readily as is the Beach shield or any other device excepting an open cutting, which is not to be considered.

Should Mr. Cooper have a work in hand in material such as this device was designed for, it would be surprising if he allowed himself to be caught attempting to drive an immense shield through it bodily. A little earnest study of the problem would convince him that he must leave himself more freedom of adaptation to varying conditions than he could have with any such ponderous apparatus as the Beach shield.

The conclusion appears to be unavoidable that both of these gentlemen failed to take sufficient counsel from their experience and knowledge of what has been successfully done with far cruder apparatus, in driving tunnels where the conditions were fully as difficult as in the case considered.

L. L. Buck.

[This manuscript was in our hands on Monday, that is, 36 hours before it was known what the decision of the commissioners would be. Mr. Buck designed the plans for excavating and constructing Mr. Worthen's tunnel and is therefore the man best qualified to answer the criticisms of those plans. Few engineers will doubt that if Mr. Buck undertakes to carry a tunnel under Broadway or anywhere else he will do it. The man who renewed the towers of the Niagara suspension bridge without interrupting the movement of trains over it, is not likely to let Trinity church fall into a tunnel.—Editor Railroad Gazette.]

German Notes on American Railroads.

A great many railroad men in the United States will recollect with pleasure the visit to this country last summer of Herr von Borries and Herr Bütte, respectively Superintendents of Motive Power of the Hanover and Magdeburg Divisions of the German State railroads. The keen and eager interest which Mr. Von Borries showed in everything that he saw, and his generous appreciation of all that was good in America, made it a pleasure to help him to get the information that he was after, and all who met him and his traveling companion will be interested to read the following report, which he recently made at a meeting of the Verein für Eisenbahnkunde at Hanover. Our report is translated and somewhat condensed from the columns of Glaser's *Annalen*:

The study of American railroads was greatly lightened and was made very pleasant for the party through the courtesy of our American railroad colleagues, as well as of engineers and manufacturers in extending every facility and assistance. This is the more to be appreciated by the fact that these gentlemen are weighted with a full share of work and responsibility and have to be very saving of their time. But our journey was by this made all the more profitable, as we were enabled within a comparatively short period of time to collect full and instructive data, and I beg through this to thank my American friends for the many courtesies extended.

The entirely unrestricted development of railroads in this country has made them widely different in many respects from European roads, constituting, therefore, a correspondingly interesting and instructive study. The function of American roads in developing the country industrially is far more pronounced and important than that of all European roads, and it is this function and the methods followed to perform it, that form the chief topic of the paper.

The prevailing European notion with respect to American railroads, according to Mr. Von Borries, is that the equipment is imperfect and crude. This, he points out, is at the present time true only of bridges and signaling apparatus, principally on the Western roads. The rolling stock and motive power and all the later additions to the road are, on the other hand, generally good and up to the requirements. On the whole, the development of all the railroad accessories is rapid and thorough, so that, in part, they are on a higher plane of efficiency than those found in Europe. The rational sub division of work and proper classification of duties are a material aid to success and have given excellent results. As examples of these, Mr. Von Borries cites the newer locomotives and cars, the air brakes and automatic couplers for freight service, and the later, large station buildings.

The results of a year's working of railroads in the United States Mr. Von Borries gives in the appended table, in which the figures for all the roads and for the Pennsylvania are contrasted with those for the Prussian State railroads. The statistics are for the year 1888-89. The figures for the American roads were taken from the annual report of the Interstate Commerce Commission, and those for the Prussian roads from official sources. Referring to item No. 3, columns I and II, it is explained that the figures do not include the extra charges for sleeping and parlor cars. From this table Mr. Von Borries draws the following comparison, pointing out, at the same time, that wages and salaries on the American lines are about three times as high as in Europe:

The rates of fare for passengers on the American lines exceed those on the Prussian lines by about 63 per cent., and the operating expenses on the former are, in general, higher by about 44 per cent. than those on the latter. On the Pennsylvania road, however, the operating expenses are equal to the German figures. On the American lines the receipts from passenger traffic exceed the expenditures by from 25 to 35 per cent. (see item 18), while on the Prussian roads the expenditures are larger by 6 per cent. The average length of a passenger journey on the former was greater by 34 per cent. than on the latter (see item 27), but the average number of passengers on a train (item 28) was lower by 38 per cent.

In freight transportation, the receipts on the American roads per unit of traffic amounted to only from 49 to 61 per cent. of the receipts on the Prussian roads (item 8), but the working expenses were lower, being only from 76 to 88 per cent. of those on the German lines. The freight receipts in this country thus exceed the expenditures by from 25 to 35 per cent., and in Germany by 55 per cent. The surplus for both passenger and freight traffic on the American lines generally is, therefore, practically uniform. On the Pennsylvania road the surplus from passenger traffic, as shown by the table, is smaller than the surplus from freight traffic; while on the Prussian roads passenger traffic shows a deficit, but freight traffic a very heavy surplus.

On the American roads a passenger-kilometre is generally more expensive than in Germany, owing to the fact that the American traveler likes comfort, and prefers frequent train service to cheapness to such an extent that, as shown by item 28, there is, on an average, one train for every 42 passengers, while on German lines there is only one train for every 68 passengers. Where the American passenger-kilometre costs less than the German one, notwithstanding the above stated circumstances and the higher wages paid, the explanation must be sought in the more rational character of road construction, the reduced cost of maintenance of the equipment, the smaller number of train hands necessary and, generally, more efficient management. The more efficient utilization of the seating capacity of the cars, due to the longer journeys and to the nature of the construction of the cars, is another important factor in this matter.

In the freight traffic of the American lines, Mr. Von Borries states it to be a very noteworthy fact that while the freight rates (item 8) amount to only from 49 to 61 per cent. of the German rates, yet the receipts for a train kilometre (item 10) reach to from 75 to 92 per cent. of the

		I. Total railroads of the United States.	II. Pennsylvania R. R.	III. Prussian Government Railroads.
	A.—*Receipts.*			
1	Traffic Receipts	Million marks	4,000	237	754
2	Passenger fares	Million marks	1,050	63.1	195
3	Passenger fare for one passenger-kilometre	Pfennig	5.6	5.2	3.2
4	Receipts from passengers, mail and fast freight	Million marks	1,240	70.6	207
5	" " " " " " for one train-kilometre	Marks	2.71	3.54	2.30
6	Proportion of above to general traffic receipts	Per cent.	31 1	29.5	25.9
7	Freight receipts	Million marks	2,580	156	492
8	" for one ton-kilometre	Pfennig	2.30	1.74	3.75
9	Total receipts for freight traffic	Million marks	2,680	156	492
10	" " " for one train-kilometre	Marks	4.30	5.28	5.70
11	Ratio of total freight traffic receipts to general traffic receipts	Per cent.	66.8	69.2	65.2
	B.—*Expenditures.*			
12	Working Expenses	Million marks	2,680	163	429
13	" for passenger traffic	Per cent	34	27.9	48
14	" " "	Million marks	934	45.6	207
15	" for freight traffic	Per cent	65.1	72.1	52
16	" " "	Million marks	1,746	117.4	222
17	Ratio of expenditures to receipts	Per cent	66.8	68.1	57
	C.—*Operating Costs.*			
18	Ratio of expenditures to receipts for passenger traffic	Per cent	75	65	106
19	" " " " freight "	"	65	75	45
20	Cost of 1 passenger-kilometre	Pfennig	4.9	3.4	3.4
21	" " 1 ton of freight per kilometre		1.5	1.3	1.7
22	" " 1 passenger train-kilometre	Marks	2.02	2.30	2.40
23	" " 1 freight " "	"	2.80	3.96	2.56
	D.—*Traffic.*				
24	Number of passengers carried	Millions	472	.....	208
25	" " passenger-kilometres	"	16,900	.....	5,951
26	" " " train kilometres	"	444	.....	87.6
27	Average length of journey	Kilometres	38.3	.....	28.6
28	" number of passengers in each train		42	.....	68
29	Tons of freight carried	Millions	548	.....	108
30	Freight ton kilometres	"	112,000	.....	13,200
31	Freight train "	"	615	.....	85.5
32	Average distance over which freight was carried	Kilometres	204	.....	122
33	" load of train in tons	Tons	182	.....	154

Prussian receipts. This favorable result, which is specially noticeable on the Pennsylvania road, is ascribed mainly to the large carrying capacity of the freight cars and to the economical performance of the locomotives.

[TO BE CONTINUED.]

Gold's New Steam Coupler.

The cuts herewith show the new universal, straight port, steam coupling, just brought out by the Gold Car Heating Co., for car heating connections. The body is made of malleable iron, with the nipple made on the body, as shown. The interior view shows a direct port. Over the nipple the hose is drawn, and fastened either by clamps or patent hose collars, or other suitable fastenings.

To insure the bodies locking firmly together when coupled, on the side of each body a spindle or stud is cast, and the roller shown is placed over the stud, after which the stud is countersunk down over a countersink made in the roller. In this way, when the lugs engage with the rollers, they turn on the studs when coupling, no wear takes place, and the friction is reduced to a minimum. On the other sides of the coupling bodies are the locking arms or lugs which project beyond the end of the body, and are formed with a hook adapted to engage with the roller and stud. To couple, the heads are brought together so that the locking projections on either side engage with one another; then the bodies are tilted downward, bringing the seats together.

The head of each body is made in the form of a spherical socket (see figs. 2 and 3) to receive the seat, having sockets for receiving the pivot of the seat on each side of the head, and serving to guide the heads together when being coupled.

The special construction of the seat is as follows (see fig. 4): Each seat is made of an asbestos composition, formed externally as a segment of a sphere, mounted in a tubular thimble of metal, or other material. This thimble is made with two opposite guide fingers, or stop projections, which project inwardly and engage the base of the socket in the coupling head. This limits the movement of the seats. The seat is loosely pivoted on the horizontal axis of the spring, which is in a horizontal plane and extends from the seat inwardly through the opening in the head. The spring is pivotally connected to the seat, and constructed to engage the head and hold the seat to position. It is formed in loops; the outer loops engage the interior of the head, and the intervening loop is for pulling out, when the seat needs replacing, or for other reasons. By the ease in removing seat, the interior of the coupling body is rendered easily accessible. The metal thimble prevents any contraction or pulling out of shape, and provides a perfect steam passage at all times.

A fine strainer is inserted in each coupling body and is kept in position by its own spring movement and the spring on the seat. This prevents any scale from being blown into the traps to choke them up.

The drip trap is shown in fig. 5. The principle is gravity only. As will be seen, the trap by its own weight is open when no pressure is on it, but about 1 lb. of steam pressure behind the seat closes it absolutely. The baffle plate assists in closing the trap as well as in opening it. There are no parts to get out of order and the strainer in the coupling body prevents any scale from choking up the drip passage.

Some of the distinguishing points claimed are a perfectly straight port coupling; the compensating faces are simple to adjust, remove or replace; the compensating feature of the faces insures a tight joint and allows for universal motion of couplings with least possible wear or friction: the coupling may be used with traps or not as may be desired.

Fig. 1.

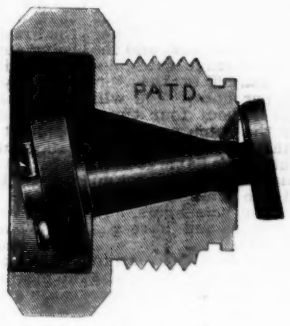


Fig. 5.

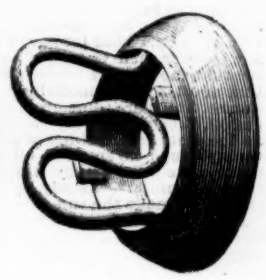


Fig. 4.

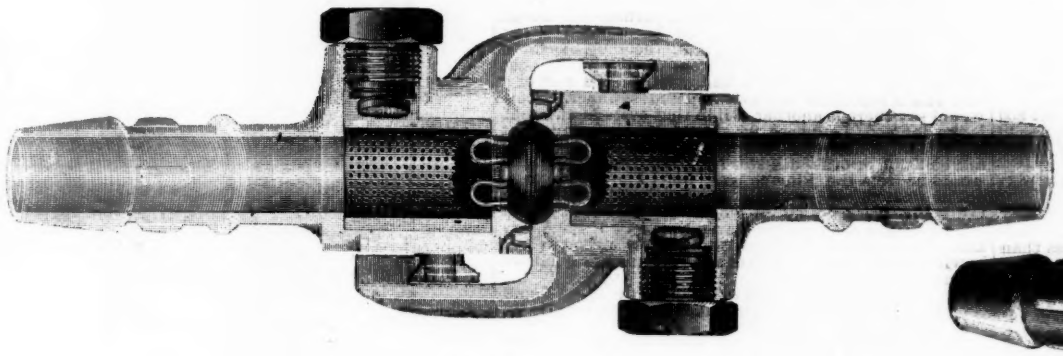


Fig. 2.

GOLD'S UNIVERSAL STRAIGHT PORT STEAM COUPLING.

Fig. 3.

Rapid Transit in Boston.

We have received a pretty full abstract of the report made by Mr. Desmond Fitz Gerald to the Boston Rapid Transit Commissioners, giving the result of his recent examination of this subject in Europe. It will be remembered that he went abroad for the city of Boston to study and report upon the means of city transit in England and the Continent. That portion of his report which deals with ordinary street cars and omnibuses is important and interesting, but we shall reproduce none of it. What follows is from his report.

London and Berlin are especially well provided for in a system of railroads by which quick transit is afforded between the suburbs and the stations on the city roads and ready connection with the great railroad systems of the countries. In addition to this Berlin has a grand elevated railroad structure for four tracks dividing the city and solving effectually the question of rapid transit, not only for suburban travel but for through travel.

The Metropolitan and District Railway systems of London are described in some detail. These operate about 60 miles of road. They are double track underground roads which have been in operation many years. Besides a large suburban travel they land passengers close to the great railroad stations in the city, and sell tickets from their stations to points throughout the kingdom. The average fare per passenger last year was 2¼ cents, the penny fares in the heart of the city being a very important part of the travel. The competition with the omnibus lines is a very serious matter for these roads, and the point was particularly made that in laying out schemes of this sort it is of great importance to build them near the lines of business travel. The ventilation of these London underground railroads was not so bad as Mr. FitzGerald had anticipated, and the management is perfect.

The City & South London Subway is described in some detail. Mr. FitzGerald rode through this several times, and standing on the rear platform of the last car inspected the tunnels by the aid of a lantern. He found the noise like the roaring of the ocean after a storm. The air in the cars was not good, although that in the tunnel seemed fresh enough. The temperature was about 50°. Many persons with whom he talked always had a headache for some time after leaving the cars of this railroad, and he felt a similar sensation every time that he went through the tunnel, which was at least a dozen times. If such a tunnel were built in Boston the temperature would be about 40°, not a very inviting place for delicate persons on a summer's day. On the whole, he could not recommend this system for Boston.

One of the most perfectly constructed steam railroad tunnels is that under the Mersey, from Liverpool to Birkenhead, 1⅛ miles. This is gradually creeping out and connecting itself with the great railroads, so that now a passenger can take a ticket at the Mersey Building in Liverpool, direct to many stations in the kingdom. This is one of the most perfectly ventilated tunnels. There is an air tunnel 7 ft. in diameter running along the main tunnel and connected with it in the centre by a shaft that can be opened and closed at will. Through this ventilating tunnel air is exhausted by a fan, being taken through the shaft connecting the two tunnels. The railroad tunnel is kept perfectly dry, and the foul air being exhausted from its centre a current of fresh air constantly flows in from either end.

Mr. Fox, the engineer of the Mersey tunnel, is associated with Mr. Greathead in building an elevated railroad along the docks in Liverpool. This is six miles long, built of iron, with a solid floor probably ballasted. It will cost £80,000 per mile, and is intended entirely for local passenger traffic. It connects with no other road.

The one municipal railroad which excels all others in its workmanship, in its situation and in the facilities which it affords, is the elevated railroad of Berlin, which gives the citizens of Berlin easy, cheap and rapid transit and offers a direct line of communication between the great railroads of the German Empire. If Boston had such a railroad the people from its northern suburbs or from northern New England could come to a central station on the north side of Boston, pass over this via duct road, with three or four stations in the city, to a central station on the south side, where they would take trains carrying them to the southern and western suburbs, and also on long-distance journeys throughout the United States. Thus they could check baggage and buy tickets through and avoid the necessity of two or three transfers. He is much afraid that no private corporation can afford to build such a road in Boston, but if built it would be of inestimable advantage to the people of that city and the suburbs, and would solve a great part of the rapid transit question.

Car Lighting.

At the last meeting of the New England Railroad Club the subject of car lighting was introduced by Mr. F. D. Adams, General Master Car Builder Boston & Albany Railroad. An abstract of the discussion follows:

Mr. ADAMS: It may be well to go back to the early history of railroad cars in this country to show that we have made some degree of progress in lighting cars. I can look back to some time in the forties when we used whale oil for lights, with a small lamp which produced a very small blaze, very smoky, and afforded very little light. In fact somewhat earlier than that trains did not run in the night, and most of the travel was done in the daytime. After a while kerosene began to be used on some roads, others avoiding it as too dangerous. After a further period candles were introduced and generally used all over the country for a long time, until such strong complaints were made that something better was devised, and mineral sperm oil, so called, was introduced, giving a light much superior to the candles, and that soon came into pretty general use, and is even now perhaps more used than anything else for this purpose. But this light is very much complained of. Most of the lamps on the road with which I am connected still furnish that kind of light, using ordinarily sperm oil. That oil can be made, by using a special burner, such as is shown in here in the hall to-night, to produce a very brilliant light, and that burner is being introduced quite extensively,

and I think we can say without fear of contradiction that this is the best and most brilliant light that has ever been introduced into a car. I believe it gives the most light of any, the Pintsch light notwithstanding. I am willing to concede that there are objections to this light, but there are also advantages. The objections are those which pertain to any oil light. It is difficult to take care of, and the trainmen will not care for the lamps so as to get the best light out of them. They will get dirty, the chimneys smoky, and oil is not a nice material for lighting cars.

Attempts have been made to use the electric light on cars. Our road ran two trains for two years thus lighted, at an enormous expense, while we did not get a great deal better light, in fact not as good a light as that in the hall with the same number of burners. No road can afford to put electric lights on its trains; any road of modest dimensions would be ruined by it in a little while.

The Pintsch light is probably being introduced now to a greater extent than any other in America, and it is an excellent light, clean, easily cared for, and perhaps not exhorbitantly expensive. I have a memorandum of the expense pertaining to this light. I have gone back to 1876, so as to make a comparison between the cost of the present Pintsch light and the oil lamps or candles. At that time the cost of lighting candles was .59 of a cent per hour for each candle, candles costing 24 cents per pound. The cost of mineral sperm oil, which was being introduced at that time, was 55 cents per gallon, and the cost per lamp, which was much smaller than the lamp used now, per hour, was .64 of a cent, but the oil gave about eight times more light than the candle. At the present time this same oil costs only about one-seventh as much as in 1876, so that the same lamp would cost now only about .09 of a cent per hour. At this time the Sherburn lamp, or the lamp made by Page Bros. & Co., which is a round wick lamp and consumes more oil, gives a light of about 60 or 70 candle power to each burner, the cost of each burner being .18 of a cent per hour. The average cost of lighting 12 cars with 116 four-flame lamps (464 flames) for seven months, from Dec. 1 to June 30, furnished with Pintsch gas, was $185.66 per month, the highest being for December, $280.66, and the smallest being for June, $84.28. The average consumption of gas per hour for each flame was 1.65 ft; the average cost for each was .83 of a cent per hour. You will see that the average cost of the gas is about four times that of oil, with no more light for the same number of flames, but there some great advantages in the gas over the oil, it being entirely clean, while oil is liable to drop on the seats and clothing of the passengers; there are no smoky lamps, no smell of oil, and the lamp cannot be manipulated, either by trainmen or passengers, and there is a uniform, steady light, provided you have gas enough to make the run over the road.

For myself, I should prefer that light in the hall to any other I have seen, if everything could be done that should and might be done to keep the lamps in proper condition; I think all must admit that the Sherburn lamp with the round-wick burner gives the most brilliant and best light. It is impossible to get men to take care of oil lamps as they should be cared for to make them clean and neat; they require much care and time, while gas is no trouble at all; you simply turn it on, and it is regulated as to the flame just as you choose.

Mr. Coghlan: What is the relative cost of equipping a car, say, with five double-burner, central draught lamps and an equivalent number of Pintsch gas lamps?

Mr. Adams: Five double-burner oil lamps, standard on the B. & A., would cost about $150 to $160, about $30 each. The Pintsch gas equipment would cost $175, less 10 per cent., about $156 or $157; then the five lamps would cost $150 more; something over $300 in all.

Mr. Coghlan: Does that include the labor of putting in?

Mr. Adams: No, sir; it does not include labor in either case. It is more labor to put up the Pintsch lamp than the other. It would probably cost something less than $20 to put up the fixtures for the Pintsch lamp, per car, including piping and everything.

Mr. Lauder: Five Sherburn lamps cost, in round numbers, $150; the application of the light $15 more, making $165 to equip a car. To equip the same car with Pintsch lights, including platform lamps, which will apply to all of ours, will bring the figure pretty near $400. That I think would be a fair answer to the inquiry of Mr. Coghlan. We have with us the Boston agent of the Pintsch Gas Light Co., Mr. Oldham, and the engineer of the company from New York, Mr. Dixon, and I would like to hear from them.

Mr. Adams: I perhaps should have answered Mr. Coghlan a little more fully. We equip our cars with two tanks for the Pintsch light instead of one, which goes with the ordinary equipment, and this adds $85 to the cost; we also put on platform lamps, which is an addition, I think, of $15 a piece; and we also put in bracket lamps where necessary in the saloons, and these increase the expense, and Mr. Lauder is quite right in saying that the equipment of a car as the cars are equipped on our road and his comes up to $400. In estimating the comparative cost we should take the number of burners, as some lamps have more, and some less. I have seen statements in the papers which do not agree with my figures at all, but I stick to them because they were carefully arrived at, the gas measured and everything carefully done; we took the average for seven months, which is fairer than to take a single month, as the months differ largely.

Mr. Robert M. Dixon: Mr. Adams and Mr. Lauder go a good deal further on their roads than is customary with the Pintsch equipment in putting in two tanks and a good many lamps. We have made the cost of equipment just about the same as that of oil lamps, as far as the lamps are concerned, and that is about as well as we can do. As to the expense of operating this system Mr. Adams' figures are correct. We have not claimed that the cost of the light per hour would be less than .83 of a cent per hour per lamp. I have figured up the cost of lighting by oil, from statistics furnished by four different roads, and find it to be, including care of the lamps, .82 of a cent per hour per lamp. An estimate by Mr. Octave Chanute, C. E., made the cost of .84 of a cent. I do not believe the Sherburn lamps are as expensive per candle power as modern oil lamps. In reading Smiles' work on the Lives of George and Robert Stephenson, I find an interesting item in regard to the early lighting of cars, that the driver was in the habit of stopping and buying a penny candle, which he stuck in a hole for the benefit of the passengers. Mr. Oldham has prepared a few facts, and I will now give place to him.

Mr. Adams: The figure of $\frac{1}{100}$ of a cent an hour for oil was simply for the oil consumed, and did not include the repairs and attendance for oil lighting. He had no doubt that the figures quoted as including them all were about correct.

Mr. D. J. T. Oldham: Three years ago Mr. Theobald Fostall, one of the most eminent authorities on artificial lighting, wrote as follows: "I believe that your compressed gas system will be found to furnish the cheapest and most reliable light for passenger trains" Since that time many prominent gas engineers have become interested in the establishment of stations for the supply of Pintsch gas, and it has been adopted for use by thirty American railroad companies in addition to those using it at that time.

It is not claimed for this system that it can supply more light than any other. Any amount of light can be supplied by it, or by oil lamps, or by electricity, but it will supply as much as either, and do so more reliably, more conveniently, and at less cost. In car lighting a large amount of concentrated light is not desirable. It is more efficient to have the same candle power distributed from smaller lights throughout the car, because the intensity of light diminishes as the square of the increased distance. Also with more sources of light the shadows are lessened in number and area.

The greatest obstacle working against the rapid introduction of the Pintsch system here in earlier days was the promise held out by electricity of becoming available for car lighting. It had many advocates in America and Europe. Three large American railroads are now using the system on their principal trains where formerly electricity was used, and the news has recently arrived of its general adoption by the London, Brighton & South Coast, of England. This company has been using quite generally the most approved form of electricity for passenger train lighting.

Mr. Lauder: While we are using the Pintsch gas quite extensively, and preparing to use it more, there are a great many conditions of railroading that make it very hard to use gas in lighting cars. The road I am connected with is badly cut up, it is a road of branches, and a great many of our cars never get to large terminal points. Therefore, it would take a large number of gas plants, located all over Massachusetts, to light our cars as if we adopted that system.

There are other systems which give as good light as that, which are not subject to those objections; one is the Frost carburetter system. It has the advantage of being applicable to any car under any conditions, and carries its own material with it. With the Pintsch system you have got to run your cars where there is a gas plant. The Frost system uses gasoline, a very inflammable material, and many object to it as too dangerous; but we use things in our paint shops quite as dangerous, and with reasonable care in handling it is safe. Another serious objection to it is that it requires a great deal of care and an intricate knowledge of the system. When properly run it gives the most beautiful light I ever saw in a car, brilliant, soft and intense. The Frost lamps "kick" sometimes, and can not be made to burn, and it is a good light only in the hands of experts.

The question of the best method of car lighting is by no means settled yet. The question of leakage is to be considered. In the Pintsch system the gas is put into receivers under the car, at a high pressure, 8, 10, 12 or 15 atmospheres, and if there is any possible chance for a leak it will find it; everything has to be done in the best manner to stand such a pressure, especially in view of the shocks and jars incident to running a railroad train. The simplest, most economical, and, perhaps, all things considered, the best system of lighting to-day, is that lamp which you see here in the hall; the only objection to it is the heat which it throws out in producing that brilliant light, which has a bad effect on the roof of a car, and is especially objectionable in summer. Some would say there is another evil in that system, and that is the danger. I suppose we should have to admit that there is more danger of the cars getting on fire in case of a collision or other disaster from that lamp than there would be from the Pintsch gas; but I know of no well-authenticated case where a fire has been started in a railroad wreck from lamps when filled with 300 fire test oil. It is very commonly believed that we burn ordinary kerosene oil in our car lamps, and there is a good deal of howling against it; but you can take a pan of the oil we use and put a fire out with it.

Mr. Adams: With regard to leakage, we have found less trouble with the German tanks than with the American, as to leakage. With reference to the burning of cars by lamps, I don't believe that anybody can point to a case where a car took fire from a lamp, though many are so reported. [The German tanks are made for a pressure of 10 or 11 atmospheres, and tested to 16.]

Mr. Chamberlain: I believe that with an oil lamp with proper oil, there is no more danger of setting a car on fire than there is danger of a Baker heater setting a car on fire. I believe that four double-burner Williams & Page or Sherburn lamps will give more light in a car than an equal number of Pintsch gas lamps, four burners to a lamp. I have made no experiments, but I have seen both lights. If it costs $300 to $400 to equip a car for lighting with the Pintsch gas, as has been stated, take the lesser sum, and say it costs $300 per car, and that a road has 800 passenger cars in service, you start off with $240,000 for its lighting equipment, a sum which most roads could hardly stand, as against $120,000 which it would cost to equip the same cars with four double-burner Williams & Page or Sherburn lamps. The labor of putting up oil lamps is comparatively nothing, while the labor of putting up the other device amounts to considerable; especially as in the substitution of gas for oil you have something to throw away. It is claimed by the Pintsch people that their gas is safer than oil, but I never knew of a case where a car lamp set a car on fire by reason of a collision.

Mr. Dixon: A road with 800 cars would not buy gas at the price Mr. Adams mentioned, but would put up its own works and make its own gas, which, it has been demonstrated beyond question, is cheaper than lighting with oil. We cannot run works in Boston as economically as a railroad can. A plant that will supply 400 to 500 cars costs for apparatus about $11,000, including all the distributing lines. The Erie works have cost them in the neighborhood of $15,000. They have 380 cars equipped and running, and supply their ferry boats and shops; they have many cars they do not use gas on. For 100 cars the cost would be about $5,000 for works. Something has been said about danger from lighting with the Pintsch system. We have never had any trouble, nor should we apprehend any danger from leakage in the car; one tank does not carry enough gas to cause an explosive mixture in a car.

Mr. Adams: Wherever there would be a concussion sufficient to break up these lamps and let the gas escape it would also break the car or make a hole in it and the gas would soon evaporate into the open air. I never supposed there was any danger in lighting with gas.

Mr. Richards: We burned the Pintsch gas a good many years ago on the Stonington line, and never had any trouble with it. The cars were not so well lighted as now, but we did not have so many lamps, and the service was satisfactory. I would like to know how many Pintsch lighted cars there are.

Mr. Dixon: There are about 35,000 altogether.

Mr. Butler: The New York & Providence Co. had gas on their cars several years ago, and have added some to their equipment; the Gilt-edge has it in. We have labored under the difficulty of having our gas at Stonington; there was one time when we transported our gas to New London; since we have got our plant at Mott Haven we are relieved from carrying the gas a long distance. Some years ago we made an estimate as to the comparative cost of lighting by the Pintsch gas and by oil, and it resulted in favor of the gas, for maintenance and everything, including the interest on the plant. The carelessness with which the lamps are often managed by the men who care for them leads to much complaint on the part of the passengers whose clothing is soiled, but I notice that it is always the most expensive garments that get oil on them.

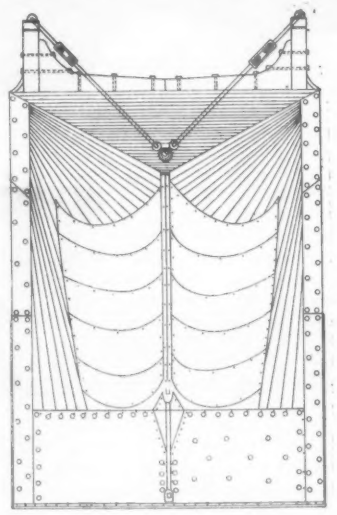
Mr. Lauder: Mr. Butler puts this matter in a proper light. It is not entirely a question of how much oil is burned in the ordinary car lamp or how much gas is burned under the Pintsch system. It is the question of maintaining the light in the cars with the two systems. Now I believe that the furnishing of material and the maintenance of the light and the lamps in the car, including the paying for silk dresses ruined by oil, would make in a series of years the Pintsch cheaper to maintain than any oil light we have ever had. This brings it down almost to a question of first cost.

Mr. Butler: If a man builds a fine house he puts in gas fixtures, although they cost a great deal more than oil lamps, which would serve his purpose; and in building cars the same should maintain for the greater convenience and satisfaction of the railroad management, and the public generally.

The Russell Snow Plow.

The Russell snow plow, illustrations of which are given herewith, has been used for a number of winters in the deep snows of some of the northern railroads and especially in the northeast. The Intercolonial Railroad has been the largest user and now owns 13 of these plows, and the work done by them is very satisfactory. It is claimed that they never leave the rails on account of the snow, and that they are capable of working through drifts that measure as much as 16 ft. in depth.

The plow is built in three styles of three sizes each—the single track, the double track, and the plow with



Fi . 3 – Front Elevation.

elevator wings. The first is, as the name indicates, intended for clearing a single track road, and throws the snow equally on each side of the roadway. The second is to clear double track roads, throws the snow entirely to the right, and can also be successfully used in clearing side cuttings on a hillside. The third has a peculiar form of elevator wings on the side, which widen the cut and throw the snow out at the top, as will b explained later on.

Fig. 1 is a central longitudinal section of a wing plow showing sills, incline timbers, the centre cutter or share and side posts. The centre timber, or backbone, in the incline is of 12 in. × 12 in. white oak, as is alsothe heavy timber, or power-bar, between the sills. The power-bar is united directly to the backbone by a saw tooth joint, while upon each side of these timbers there are two bars of 1 in. × 4 in. iron, secured by 1 in. bolts. One of these bars extends forward over the nose and has the iron coupling bar secured to it. Another method of attaching the power-bar to the backbone is shown in the detail fig. 2. Here the end of the bar is rounded and fits into a socket permitting a freer oscillation of the back end. This power-bar lies between the sills, with about 4 in. space on each side. There are no bolts or rods through it and it is not secured to the plow except at the front end. The rear end extends about 2 ft. beyond the end of the plow, and has a dead buffer to which the engine is coupled with a close link. Thus the propelling power is applied at the front end of the plow just above the centre of the front truck, and at the point of resistance of the snow instead of 30 ft. away, and at the heavy end instead of at the light end. The rear end of the power-bar can oscillate when the plow is upon a curve. This is a radical change from the usual construction of push plows, and is one of the main features of the device in question. By this method it will be seen that the plow follows the power instead of being pushed before it, or the plow is practically pulled by the nose, which explains why it does not leave the rails.

The wing elevator plow, fig. 8, has recesses to accom-

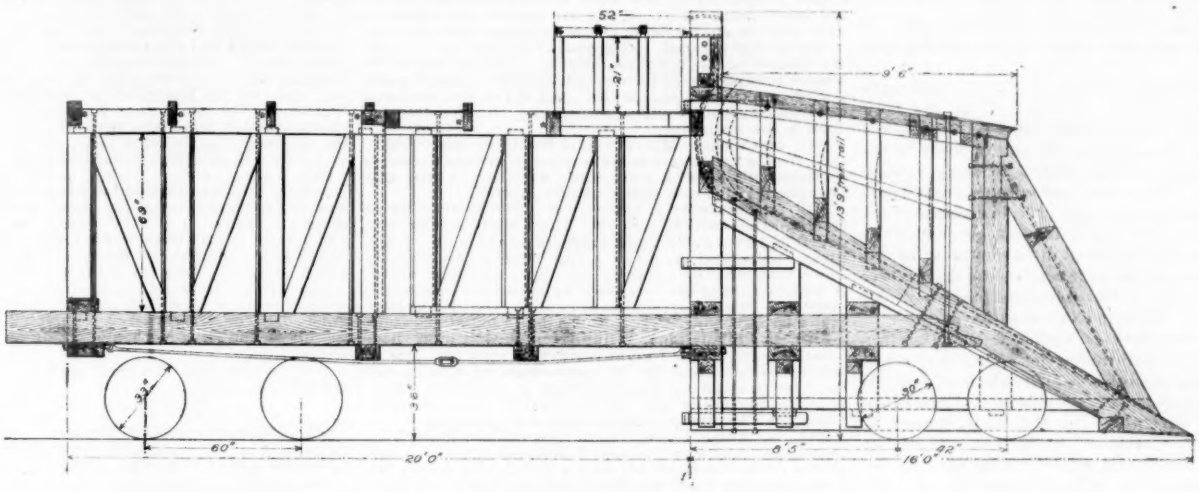


Fig. 1—Central Longitudinal Section of Wing Elevator Plow.

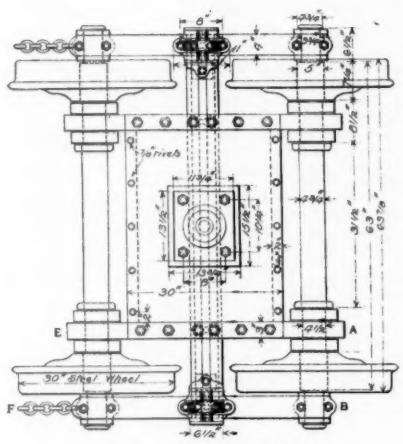


Fig. 4—Plan of Truck.

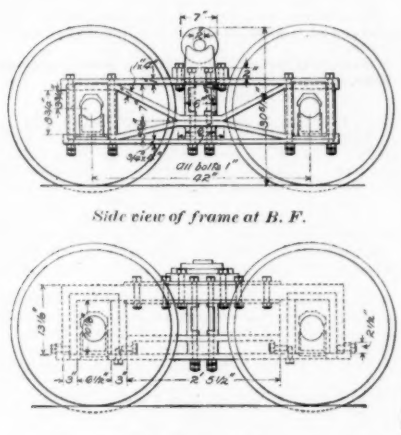


Fig. 5—Side View of Frame at A, E.

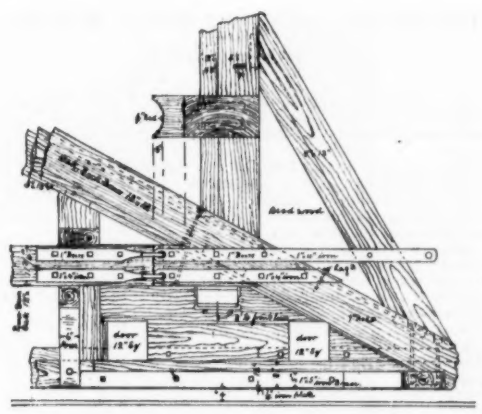


Fig. 2—Detail of Nose.

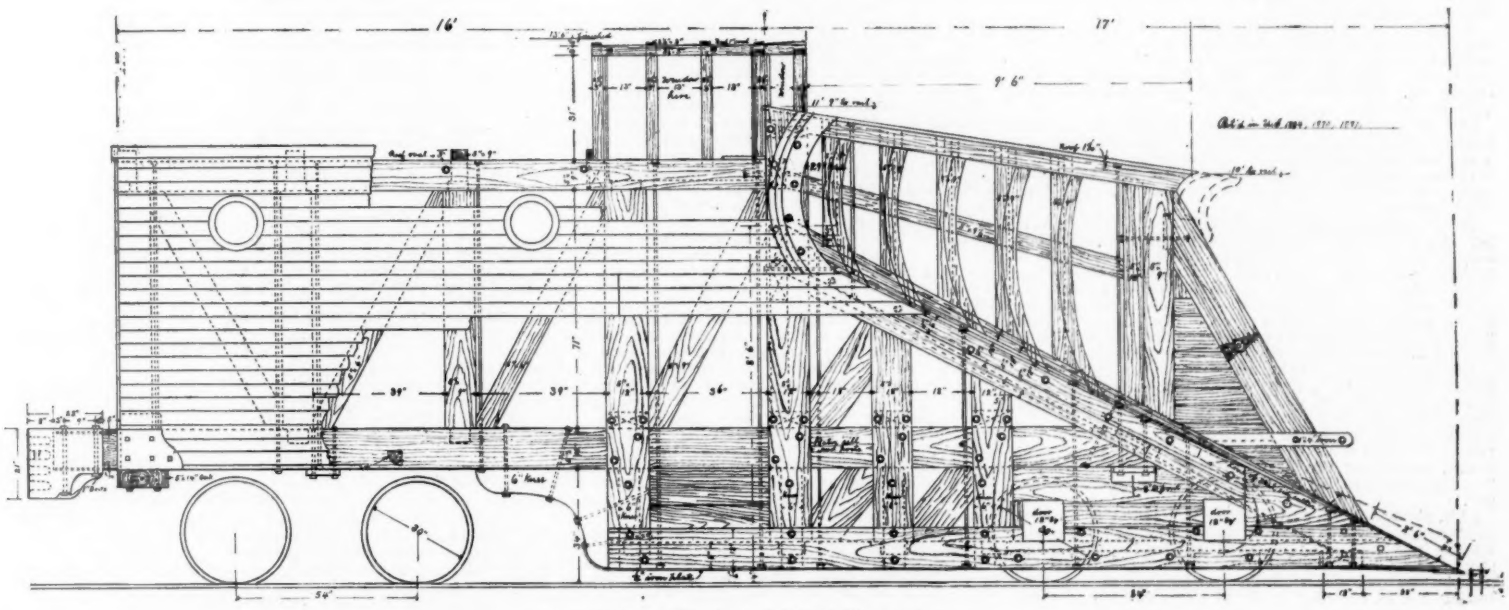


Fig. 6—Side Elevation of Single Track Plow.

THE RUSSELL SNOW PLOW.

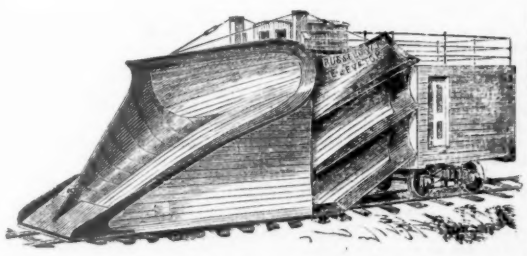


Fig. 8—Single Track Wing Elevator Plow.

modate the wings. These wings are made of two layers of oak plank at right angles to each other and securely bolted together. Two elevators are now used upon each wing. They are of spruce or yellow pine, securely bolted to the oak wing, and are covered with $\frac{3}{16}$ in. steel plates, the edges being made sharp. Between the elevators the wing is sheathed with matched hard pine boards, making a smooth surface. Each wing is hung by hinges of 1 in. × 4 in. iron. The object of these elevators is to cut under the snow and lift it up, just as the inclined front does before the snow is thrown from the plow. Each wing is operated with bevel gearing by one man, and can be opened or closed independently of the other. When full extended they remove 3 ft. of snow from the sides. The plow itself cuts 10 ft. wide, thus making an opening of 16 ft. in width when the wings are extended on both sides. When they are closed they are within the lines of the sides of the plow front.

Fig. 3 is a front view of a single track wing plow, showing derrick post on each side, where the wings are hinged. The back stay rods are shown running from the top of the derrick post to the front and top of nose. Rods of 1¼-in. iron also run from the top of the derrick post to the rear of the top of the wings.

Fig. 4 is a plan of the truck used at the front end under the nose. Fig. 5 gives two elevations showing the distinctive features of the truck, which are that it has journal bearings on each side of the wheel. The inside bearings are 4½ in. diam. by 8 in. long, and the outside 3¾ in. by 7 in. long. The truck is rigid, is equipped with 30-in. wheels and has a wheel base of only 42 in. It is placed farther forward than trucks usually are, and no roller or shoe is ever used at the front end. It is assumed that this truck will carry a load of 40 tons. The rear truck is of the size and type used under first-class freight cars of 60,000 lbs. capacity.

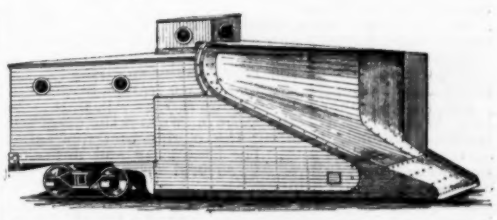


Fig. 7—Double Track Plow.

Fig. 6 is a side elevation with a portion of the sheathing removed, showing the substantial manner in which the plow is built; and here we may mention that the sides of the plow, back of the edge of the incline, slant inward 6 in. so that the snow left at the side of the cut will offer no frictional resistance. Figs. 7 and 8 are

prospective views of single and double track plows from photographs.

In working, a man is stationed in the pilot house on top; and has a bell cord with which to signal the forward engine.

The share is stationary, and its front end commences about 5 ft. up the incline, or back from the horizontal cutting edge. The front end of this share is covered with a steel plate ½ in. thick on the side opposite to the run of the share there is a steel plate ⅝ in. thick extending the full height of the plow, and with its front edge, forming the vertical cutting edge, 2 ft. in advance of the share. This enables the plow to first get under the snow and, wedged and weighted upon the track, to lift the snow, and loosen it before it reaches the share where the side pressure begins. This obviates the early side pressure which is so likely to cause derailment.

In finish the woodwork is shellaced and the iron painted black, so that externally the plows have a fine appearance, and the smoothness offers the least possible resistance to the snow. This snow plow is the result of experiments and inventions by Mr. J. H. Russell, of Maine, and Mr. J. W. Russell, of Boston. It will be manufactured in the United States exclusively by the Ensign Manufacturing Co., of Huntington, W. Va., New York office, 11 Pine street, and Mr. J. W. Russell is agent for its introduction.

Train Accidents in the United States in September.

COLLISIONS.

REAR.

1st, on Pennsylvania, near Spruce Creek, Pa., a freight train broke in two and the detached sections collided, wrecking 12 cars. A brakeman and 2 tramps were injured.

1st, on Alabama Great Southern, at Dudley, Ala., a freight train ran over a misplaced switch and collided with some box cars standing on a siding, 3 of which, together with the engine, were damaged. Three trainmen injured by jumping.

4th, on Chicago & Alton, near Higginsville, Mo., a freight train ran into the rear of another freight. The engine was disabled, and caboose and 5 loaded cars were wrecked and burned. Fireman fatally injured and engineer badly hurt.

5th, on Lehigh Valley, in Allentown, Pa., a freight train collided with a coal train, wrecking engine and a dozen cars. Engineer and fireman severely injured in jumping.

9th, on West Shore road, near Haverstraw, N. Y., an excursion train ran into the rear of a freight train, damaging the locomotive, the caboose and 2 following cars. Fireman injured.

11th, on Valley road, at Everett, O., a freight train was run into by a special. The caboose was badly damaged, injuring a passenger.

11th, 7 p. m., on Wabash road, near Mexico, Mo., a work train ran into a detached section of a freight train which had been left standing on the main track without tail lights. Two cars next the caboose contained lubricating oil. This was ignited by the shock and 6 cars were destroyed.

12th, on Housatonic road, at Branchville, Ct., a special officers' train ran into the rear of a passenger train as it was about to take a siding. The Superintendent of the division, who was riding on the colliding engine, was injured by jumping, and several occupants of the train were bruised.

14th, night, on Southern Pacific, near Girard, Cal., a passenger train which had been stopped and delayed by a landslide on a steep descending grade was run into by a following freight train, badly damaging the rear car. A passenger standing on the platform was killed and 3 other passengers were injured. The freight was running slowly but the grade is very steep. The passenger train had stopped once before and left a signalman, but failed to send another man on stopping a second time.

15th, on Fremont, Elkhorn & Missouri Valley, at Rawhide Switch, Neb., a light engine occupying the main track against orders, was run into by an extra freight, wrecking the tender and killing the fireman.

16th, on Baltimore & Ohio, at Cumberland, Md., a passenger train ran into the rear of a freight train on a curve, damaging the locomotive, caboose and several box cars, and injuring fireman, brakeman and a passenger.

16th, about 9 p. m., on Chicago, Burlington & Quincy, at Montgomery, Ill., extra eastbound freight train No. 123 ran into the rear of freight train No. 92, which had stopped to do some switching, throwing several cars over on the opposite track in the face of approaching freight No. 75, running about 15 miles an hour, making a pretty bad wreck. Engineer killed and brakeman injured.

18th, on Philadelphia, Wilmington & Baltimore, near Newport, Md., a freight train ran into a preceding freight, wrecking an engine and 15 cars. Engineer killed, fireman and conductor injured. There was a dense fog at the time.

18th, on New York Central, at Port Byron, N. Y., a freight train stopping at a water tank was run into by a following freight, the engineer apparently failing to notice the signals of the rear brakeman. Engine, caboose and 8 cars were wrecked. Two tramps injured.

19th, on Milwaukee, Lake Shore & Western, near Ashland, Wis., a freight train broke in two and the detached portions collided, derailing the engine and damaging several cars and caboose. The conductor and a brakeman were fatally injured and several passengers in the caboose were badly bruised.

19th, on Baltimore & Ohio, near Martinsburg, W. Va., a passenger train ran into the rear of a freight train, wrecking the caboose and killing the conductor.

23d, 2 a. m., on Southern Pacific, near Baden, Cal., a stock train broke into three parts and two of the parts afterward collided, making a bad wreck and killing a large number of sheep.

24th, 6 a. m., on Pittsburgh & Western, at McKim's Siding, near Zelienople, Pa., a work train which had stopped because a preceding train had broken in two was run into at the rear by a following freight, the flagman not going back far enough and the morning being foggy. The collision was slight, but the empty platform cars in the work train were overturned and fell upon the workmen, of whom 7 were killed and 5 injured. The engineer was also killed.

27th, on Pittsburgh, Fort Wayne & Chicago, near New Waterford, O., a freight train ran into the rear of a preceding freight which had been suddenly stopped by the automatic application of the air brakes, wrecking 12 cars, and the engine being thrown over an embankment. A tramp was injured. It appears that the second train was following the other too closely. The setting of the brakes is supposed to have been caused by a loose hanger permitting the air pipe at the end of the last air-brake car to spring out of place sufficiently to open the stop cock in the train pipe.

26th, on Chicago, Milwaukee & St. Paul, near Columbus, Wis., a freight train broke in two, and the detached sections collided with great force, wrecking 11 cars. One brakeman killed and another badly injured.

27th, on Baltimore & Ohio, near Cumberland, Md., a freight train which had just left a water station was overtaken by a fast freight train in a curved cut, piling up an engine and 25 cars in a bad wreck. An engineer and a man stealing a ride between the cars were killed. A brakeman was badly scalded in trying to rescue the engineer, who was jammed against the locomotive boiler by wreckage. There was a dense fog at the time.

28th, on Philadelphia, Wilmington & Baltimore, near Charlestown, Md., a freight train ran into the rear of another freight, due to the carelessness of a telegraph operator in allowing a second train to enter a block before the preceding one had cleared it. Caboose badly damaged. Engineer slightly injured by jumping.

29th, on Long Island road, near Blissville, N. Y., a locomotive moving at considerable speed ran over a misplaced switch and collided with a string of freight cars. Two trainmen and a machinist were seriously injured.

30th, on New York Central & Hudson River, near Spuyten Duyvil, N. Y., a freight train ran into the rear of another freight on a curve, the flagman of the former apparently neglecting to go back promptly after coming to a stop. The caboose and half a dozen cars loaded with hogs were wrecked. One trainman killed and another seriously injured.

And 42 others on 32 roads, involving 8 passenger and 64 other trains.

BUTTING.

2d, night, on Cincinnati, New Orleans & Texas Pacific, near Nemo, Tenn., a northbound passenger train struck a car of lumber which had been pushed out of a siding by a freight train. Engine damaged and fireman injured. It is said that the brakes on the lumber car were defective.

5th, on Michigan Central, at Lowell, Mich., butting collision between a freight train and a construction train, due apparently to confusion about sidetracking. Both engines were damaged and an employé was killed.

10th, on Union Pacific, near Pickerell, Neb., butting collision between a passenger train and a special, wrecking both locomotives and damaging the ends of the foremost cars; 1 passenger killed and 3 trainmen and another passenger injured. Cause, operator's failure to deliver orders.

13th, on New London Northern, a locomotive started out of a roundhouse at New London, Conn., unattended, ran out upon the main track and collided with a southbound passenger train near Waterford, 8 miles distant. Both locomotives were wrecked and the engineer was badly hurt.

15th, on New York, Lake Erie & Western, near Allegany, N. Y., butting collision between two freight trains in which both engines were wrecked and ditched, seriously injuring an engineer.

15th, on St. Louis, Iron Mountain & Southern, near Corning, Ark., butting collision between a passenger train and a freight train, due to one of the crews overlooking an order. Both engines were badly damaged. A brakeman, another employé and a passenger injured.

16th, on Illinois Central, near Galena, Ill., butting collision between two freight trains, due to misunderstanding of orders, wrecking 3 engines and many cars. Fireman badly injured.

17th, on New York, Lake Erie & Western, in Jersey City, N. J., butting collision between a passenger train and a freight train, disabling both engines, wrecking several cars and killing about 20 head of sheep. A brakeman was badly hurt.

18th, on Cincinnati, New Orleans & Texas Pacific, near Harriman Junction, Tenn., butting collision between freight trains, badly damaging both engines and several cars and killing a fireman and a brakeman. It appears that the northbound train started away from the last preceding station without an order from the conductor, he being in the telegraph office receiving an order to wait there for the southbound train. The northbound train had been waiting for a southbound passenger train, and as soon as the latter passed a signal was given for the freight to move forward a short distance, but this signal was misconstrued to mean "all right" for the next station.

18th, on Union Pacific, at Port Neuf, Idaho, an eastbound passenger train approached the station at uncontrollable speed and collided with a westbound passenger train standing there. The forward portions of both trains were considerably damaged. A mail clerk and 4 Indians stealing a ride were killed and 3 trainmen and several other tramps were injured.

19th, on West Shore, at Haverstraw, N. Y., a northbound passenger train ran over a misplaced switch and into the head of a freight train standing on the side track, pushing it back about 80 ft. and wrecking the engine, baggage car and several freight cars. Baggage master slightly injured.

21st, on Pennsylvania, near Sunbury, Pa., a special train, consisting of engine and one car containing a bridge gang, collided with a work train, wrecking both engines. The engineers and firemen were seriously injured by jumping, as were also several of the brakemen.

22d, on Chicago & Northwestern, near Beverly, Ia., butting collision between a passenger train and a stock train, slightly injuring several passengers.

23d, on Western & Atlantic, at Smyrna, Ga., passenger train No. 4 ran over a misplaced switch and into the head of freight train No. 15, badly wrecking both engines and several cars. One engineer killed and 3 other trainmen and a tramp injured. The switch had been left wrong by a train that had pulled out of the siding some time before.

24th, on New York & New England, near Hawleyville, Conn., butting collision between two freight trains, killing 3 trainmen and injuring another. The westbound train was running on the time of the other, which, although late, had the right of way.

26th, on Maryland Central, near Owings Mills, Md., butting collision between two freight trains, damaging both engines and three cars. Engineer and conductor injured.

27th, 1 a. m., on Northern Pacific, near Buffalo, N. D., a westbound freight train in going upon a side track pushed a car load of oil ahead of it for the purpose of making room to clear the main track; the oil car got away and ran out two miles on the main track where it struck the head of an eastbound stock train, making a very bad wreck which at once took fire. Engineer and fireman killed and a brakeman badly hurt. A drover was also injured. The cattle train ran some distance after striking and demolishing the oil car, and hay protruding from the cars hastened the burning of most of them. Sixteen cars of cattle were consumed. The engine of the westbound train was promptly started in pursuit of the runaway, but failed to catch it. A passenger train was only was only 30 minutes behind the stock train.

30th, 3 a. m., on New York, Pennsylvania & Ohio, near Kent, O., butting collision between a westbound freight and an eastbound passenger train, which was the sixth section of train No. 4. The wreck was a very bad one, and several freight cars were thrown down a high embankment. Engineer, fireman and two passengers killed, and 24 passengers injured. One of the cars was set on fire by an overturned stove; two or three passengers were burned, but the flames were soon extinguished. The freight crew neglected to observe the signals on the fifth No. 4, and assumed that it was the last section.

And 14 others on 13 roads, involving two passenger and 26 other trains.

CROSSING AND MISCELLANEOUS.

4th, on Pennsylvania, at Walls, Pa., collision between extra freight train and a construction train, damaging an engine and several cars. Engineer hurt by jumping.

11th, night, at a crossing in Philadelphia, Pa., a Baltimore & Ohio freight struck the rear car of a Pennsylvania freight, which stopped unexpectedly before the rear car had cleared the crossing. A brakeman was killed and the engineer badly hurt. A dense fog prevailed at the time.

11th, on Interstate Consolidated Rapid Transit (Elevated), at Kansas City, Mo., a passenger train ran into a switching engine at a crossing and both locomotives were derailed and badly damaged. One of the engineers was scalded and a passenger was severely cut by broken window glass.

11th, on Union Pacific, near Beck's Hot Springs, Utah, a freight train ran into the side of another freight which was entering a siding, damaging locomotive and 4 cars. Engineer hurt.

17th, on Pennsylvania Co.'s line, near Richmond, Ind., a westbound express train collided with a work train at a crossing, seriously injuring a postal clerk and an employé and bruising several other employés.

21st, on New York, Lake Erie & Western, at West Susquehanna, Pa., collision between two freights, killing an engineer.

22d, on Union Pacific, at Bolles Junction, Wash., collision between passenger trains, badly damaging both engines.

23d, on Western Maryland, at Timber Grove Station, Md., collision between a passenger train and a freight train which was running on the passenger train's time. Brakeman killed.

24th, 7:30 a. m., at the crossing in Orange, N. J., a New York, Lake Erie & Western passenger train consisting of combination car and one coach, which had just started after making the crossing stop, was run into by a Delaware, Lackawanna & Western freight train. The combination car was struck and thrown against a signal tower, wrecking both. Two men in the tower were injured. A dense fog prevailed at the time.

27th, 3 a. m., on Kansas City, Memphis & Birmingham, at Gatman, Miss., passenger train No. 3 while going on a side track to meet passenger train No. 4 was struck in the side by the latter and a sleeping car was badly damaged. One passenger was injured.

And 31 others on 26 roads, involving 9 passenger and 49 other trains.

DERAILMENTS.

DEFECTS OF ROAD.

7th, on Kentucky Union, at Clay City, Ky., a freight train was derailed on a bridge by the breaking of the floor beams; the forward part of the train ran along on the sleepers some distance until it came upon a trestle beyond the bridge. The derailed engine and cars knocked down the trestle and fell to the ravine below, about 10 ft. Engineer and fireman killed.

10th, on Iowa Central, near Montezuma, Ia., an excursion train was derailed by a broken rail and 2 coaches upset, injuring about 14 persons.

23d, on Gulf, Colorado & Santa Fe, near Plantersville, Tex., a passenger train was thrown from the track by the spreading of the rails. Several cars were overturned down a bank, killing a child and injuring the conductor and 5 passengers.

And 7 others on 6 roads, involving 3 passenger and 4 other trains.

DEFECTS OF EQUIPMENT.

13th, on St. Louis & San Francisco, near Valley Centre, Kan., a car in a freight train broke down and 6 others were wrecked. Brakeman seriously injured.

14th, on Southwestern, near Oglethorpe, Ga., 10 cars of a freight train were derailed and ditched by the dropping of a drawhead. Brakeman killed.

14th, on St. Louis & San Francisco, near Valley Centre, Kan., the caboose and 4 cars of a freight train were derailed and wrecked by the breaking of a truck, injuring a brakeman.

19th, on Charties road, at Canonsburg, Pa., 2 cars of a circus train were derailed and wrecked by the dropping of a brakebeam, injuring 5 circusmen.

25th, on Utah Central, near Altus, Utah, a passenger train was derailed by the breaking of a truck, two cars rolling down an embankment. Several passengers slightly injured.

29th, on Missouri, Kansas & Texas, at Caney, Tex., several cars of a freight train were derailed and damaged by the jamming of the cars due to the bursting of the air brake hose. A brakeman was thrown from the train and severely injured.

And 16 others on 13 roads, involving 2 passenger and 14 other trains.

NEGLIGENCE IN OPERATING.

1st, on Atlantic & Pacific, near Dennison, Ariz., a can of powder in a car of a moving freight train exploded, wrecking it and several other cars, killing a brakeman and a man in charge of freight.

2d, on New York, New Haven & Hartford, at New Haven, Conn., a switching freight train was derailed by a misplaced switch. The locomotive was badly damaged and the fireman seriously injured.

3d, on Chicago, Milwaukee & St. Paul, near Wausau, Wis., a passenger train was derailed by a misplaced switch, damaging the locomotive and forward cars. Fireman and baggageman injured.

7th, on West Virginia & Pittsburgh, near Buckhannon, W. Va., a freight train descending a grade became uncontrollable and several cars were derailed and

thrown over an embankment. The fireman, who had climbed upon the cars to assist in braking, was killed and a brakeman was slightly injured.

22d, on Boston & Albany, near Boston, Mass., 2 cars of a passenger train were derailed and overturned by a misplaced switch, injuring 4 passengers. The rod running from the tower to the home signal for this switch had been broken and the signalman was passing trains over the switch by flag signal. A switching engine was waiting to follow the passenger train and the signalman threw the switch under the train, the breaking of the signal rod and disuse of the fixed signal making it possible for him to do this.

25th, on Baltimore & Ohio, at Linden, Pa., engine of a passenger train jumped the track at a switch leading to a private siding and was overturned, dragging the combination car with it and derailing one other car. Engineer and fireman badly injured and 2 passengers slightly hurt. It is thought that the switch had been left partly open.

30th, on Norfolk & Western, near Waverly, Va., the two rear cars of passenger train No. 2 were derailed by a misplaced switch. One passenger and one trainman injured.

And 10 others on 9 roads, involving 3 passenger and 7 other trains.

UNFORESEEN OBSTRUCTIONS.

7th, on St. Louis, Arkansas & Texas, at England, Ark., a passenger train ran over a horse, derailing the forward portion of the train, killing the engineer and badly injuring the fireman.

10th, on San Antonio & Aransas Pass, near Edgar Station, Tex., a freight train ran over a cow on a bridge and 16 cars were thrown off the bridge into a creek and wrecked, badly injuring a brakeman.

18th, on St. Louis & San Francisco, near Carthage, Mo., a freight train ran over some cattle, derailing the forward portion. Brakeman killed and conductor seriously injured.

19th, on Colorado Midland, near Glenwood Springs, Col., a stock train was derailed by a rock which had fallen down upon the track in a cut, and the engine and six cars were overturned and thrown into a stream. Brakeman killed.

20th, night, on Illinois Central, near Starkville, Miss., a work train ran into a tree which had been burned down and fallen across the track, badly damaging the engine. Engineer fatally injured.

20th, 1 a. m., on Pennsylvania, near Greensburg, Pa., an eastbound freight train ran into some wreckage which had been thrown over from the opposite track, piling up the engine and 20 cars in a very bad wreck, which caught fire and was partially consumed. Engineer and fireman killed and a brakeman seriously injured. A tramp also was killed.

22d, on Kansas City, Fort Scott & Memphis, near West Plains, Mo., a freight train was derailed by a coupling pin which had been placed upon the track, wrecking the forward portion. Fireman killed and engineer badly hurt.

And 4 others on 4 roads, involving 1 passenger and 3 other trains.

UNEXPLAINED.

4th, on Savannah, Americus & Montgomery, at Dowdy's Mills, Ga., the engine and 11 cars of a freight train were derailed on a curve and considerably damaged. Engineer injured.

7th, on Austin & Northwestern, near Burnett, Tex., a mixed train was derailed. A number of sectionmen riding on a car of lumber were injured, one of them fatally.

7th, on Newport News & Mississippi Valley, at Beaver Dam, Ky., a freight train was derailed and partially wrecked, fatally injuring two trainmen.

7th, on Louisville & Nashville, at Edgeville, Ky., 7 cars of a freight train entering a siding were derailed and thrown over a 15-ft. embankment, badly injuring the conductor.

13th, on Union Pacific (narrow-gauge line), near Beaver Brook, Col., passenger train No. 381 was derailed on a curve just after it had started from the station, 3 cars being overturned into a stream near by. Three employés and 18 passengers were injured. The train consisted of 10 cars drawn by two engines and contained about 700 passengers. The Superintendent tells a reporter that the baggage car "straightened out on the curve."

14th, on Pennsylvania, near Altoona, Pa., 2 engines and 7 cars of a freight train were derailed and thrown over an embankment, injuring an engineer.

14th, on Georgia Pacific, near Day's Gap, Ga., a train consisting of engine and caboose was derailed on a curve and rolled down an embankment. Engineer killed and fireman slightly injured.

15th, on Jacksonville Southeastern, near Springfield, Ill., a freight train broke through a bridge, 3 cars and the caboose going into the stream below. One trainman fatally and 2 others slightly injured.

21st, on Texas & Pacific, near Whitesboro, Tex., a freight train broke through a bridge, wrecking engine and several cars, and injuring the firemen.

22d, on Lehigh Valley, near Metuchen, N. J., a freight train was derailed and broke through a bridge, wrecking several cars. Conductor and brakeman badly injured.

And 22 others on 20 roads, involving 4 passenger and 18 other trains.

OTHER ACCIDENTS.

9th, on Long Island road, at Oyster Bay, N. Y., the locomotive of a passenger train standing at the station exploded its boiler, wrecking it completely and damaging the station building. Engineer, fireman and brakeman killed and conductor badly injured.

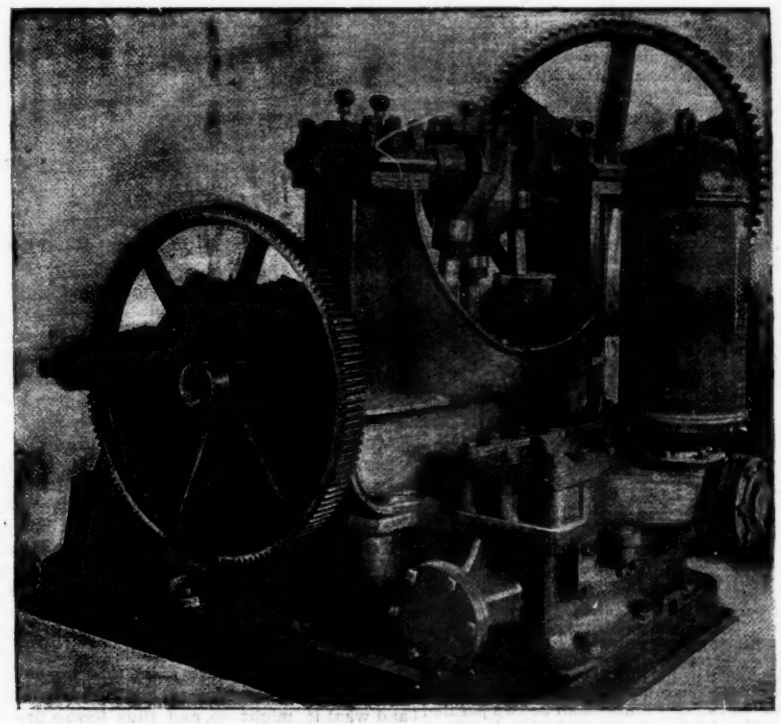
And 5 others on 5 roads, involving 4 passenger and 1 freight train.

A summary will be found in another column.

A Triplex Electric Pump.

The Goulds Manufacturing Co., of Seneca Falls, N. Y., is introducing a special, electrically operated, triple-crank, three-cylinder, single-acting pump, an illustration of which is herewith shown. The pump is designed to effect a steady and constant movement of the water without noise or clatter. Its main structure consists of three independent cylinders accurately bored, reamed and polished. On projections extending upwardly, bearings for the triple crank shaft are placed. The shaft is of steel and has the three cranks set at 120 degrees with each other. The three pump plungers, each of which is operated by a separate crank, are of the Gould "outside packed" type and move in well-fitted glands. The pumps are designed for the movement of all styles of material, of the thick or semi-fluid, dirty, or gritty kinds, and are reliable for a heavy and continuous service, the slippage or leakage of water about the plungers being kept at a minimum through ready and easy means of tightening the glands and packing.

The pumps are especially designed for electrical operation, and any of the well known methods of connection may be used. The accompanying illustration shows the pump with an extension base adapted to receive and support an electric motor for direct operation through compound gearing. The smaller pinions are made of rawhide and have brass shrouds. This method of direct connection brings the whole apparatus within the smallest possible limits of space and floor room. Any style or make of motor may of course be used. The pumps as at present constructed may be operated to a pressure of 100 to 150 pounds to the square inch.



GOULDS TRIPLEX ELECTRIC PUMP.

Rapid Transit in New York.

The report of the Rapid Transit Railroad Commissioners for the City of New York to the Common Council was submitted Oct. 20. We give extracts sufficient to show at least its scope.

The Board in entering upon its duties determined at the outset that it must lay the foundation for such a broad and comprehensive system of rapid transit as would meet the needs of the city at present and be capable of expansion in the future. That both express and way service should be provided, and that the construction should be effected with a minimum of street obstruction.

. . . Plans were submitted in great variety and number, which were carefully examined and considered. . . .

It was appreciated that any system devised with a view to permanency and the capacity requisite for the future would be very costly, and the route therefore should be along main arteries of travel, in order to give relief where most needed and to command the necessary traffic to make the line remunerative. Well known statistics established the fact that the existing north and south lines of transit nearest the centre of the city absorbed the greater traffic, and that the relative pressure upon them was substantially in proportion to their proximity to Broadway. These considerations demanded the location of the lower part of the proposed route on or near that thoroughfare. Such a route could be continued by diverging lines above Fourteenth street on the east and west sides of the city respectively, reaching the largest centers of population, now least provided with transit facilities, and avoiding the necessity of more than one route below Fourteenth street.

With this much determined, the two governing questions remaining were the general plan of the structure and the motive power to be used.

Appreciating that a viaduct of masonry would be the most desirable means of transit, the commission considered many plans for such a route. An elevated structure on Broadway below Thirty-third street was prohibited by the Statute. A viaduct of masonry was manifestly impossible on any adjacent street. A viaduct through the blocks in the lower part of the city, the Commission believed, after searching investigation, to be too costly, and subject to too many delays in the acquisition of property rights, to be within reasonable hope of attainment.

It was therefore unavoidable that rapid transit, in the lower part of the city, must be secured by an underground structure.

The location of such an underground structure through blocks near the surface was considered. This system had some advantages. The stations could be conveniently placed, and the amount of excavation would be reduced, which is a material item where the earth has to be removed through crowded streets. Many of the objections, however, to the viaduct system, as to cost and long delay in the acquisition of vast amounts of real estate, applied with almost equal force to this plan, and the Commission considered its adoption unwise. . . .

A line under Broadway being decided upon, the question was narrowed to the character of the structure and its distance below the surface; whether it should be deep or shallow; whether in providing for the four tracks necessary, the entire width of the street or only a portion should be used; and whether the surface of the street and existing pipes should be again disturbed. . . . The Commission caused borings to be made on Whitehall street and Broadway at every cross street from Front street to Thirty third street. The results are . . . indicated generally by the following table, giving the depths of the rock below the street surface at the streets named:

Front street	20 ft.	Leonard street	95 ft.
Pearl street	16 "	Walker street	107 "
Stone street	21 "	Canal street	87 "
Beaver street	34 "	Broome street	47 "
Rector street	63 "	Houston street	105 "
Fulton street	83 "	Washington place	34 "
Park place	113 "	Clinton place	65 "
Chambers street	100 "	Fourteenth street	13 "
Duane street	163 "	Thirty-third street	4 "

. . . North of Thirty-third street the width of the street was greater, and the rock formation was at such height as to admit of excavation in almost any desired form without endangering foundations. This was also the case with the east side line above Fourteenth street finally adopted. These borings conclusively disposed of the idea of a continuous rock roof for a tunnel, except at such depth or with such grades as to be almost, if not quite prohibitory,

It followed then that a tunnel for a considerable portion of its length—and that probably under the portion of Broadway where questions of property rights would present the greatest difficulties—must be driven through sand. The question was whether this could be best accomplished near the surface or at a considerable distance below, and, if the latter, what that distance should be. A decision depended upon a variety of complex considerations. Some related to the convenience and cost of construction; others, and the more important ones, to operation when completed.

The cost of tunneling at such depth as to avoid all question of property rights might be cheaper, but the extent of the cheapening would depend upon the depth, and might be easily exaggerated. Much would depend upon the number and depths of shafts used. The merecost of excavating below ground would be but a small proportion of the whole when it is considered that all the excavated material for a commodious four-track structure, with ample station and platform facilities, must be raised to the surface through shafts opening on or near crowded streets. The question also arose as to what depth would secure immunity from damages when the material to be excavated was sand, liable to be wet and to run, with this inability increasing with the depth, and when the pressure from above was that of Broadway's heaviest buildings. To this nothing but trial and experience could give an answer. The difficulties of ventilation and drainage increase with every foot of depth. A deep tunnel would require elevators as a means of access, and stairways would be necessary in addition, which, except for emergencies, would be practically useless, and to properly provide for emergencies must be broad and costly. Modern and improved elevators in sufficient numbers would doubtless provide for the regular volume of traffic at ordinary stations, but they are not believed to be adapted for large crowds, such as frequently gather on a line of transit under Broadway. Stairways 100 ft. more or less in vertical height would be of no avail as sources of relief for crowds moving upward, and would be extremely dangerous for crowds moving downward.

Moreover, it is not believed that a deep, subterranean line of transit, with elevators, would attract short trip passengers, and the short trip business is absolutely essential for the success of any line the cost of which at all approximates that of a four-track tunnel in New York City. . . . Ready accessibility by means of short, broad and commodious stairways, supplemented where necessary by elevators, better light and better ventilation at stations; light and air at intermediate points if necessary, and the feeling of greater security on the part of the public with a structure which can be more

readily reached in time of accident or other emergency, are to potent to be surrendered to mere temporary difficulties of construction.

These and other considerations led to the decision upon the part of the Commission to place the underground structure as near the surface of the street as possible, and the engineers of the board were directed to submit two separate plans, one for four tracks on a single level, the other for a double deck tunnel with two tracks upon each deck. [The plans are now familiar to our readers.—Editor.] . . .

While the double deck plan provided for subways or galleries for the pipes and other underground structures, and the Rapid Transit Act authorized the board to make such provision, yet the board felt that the intent of the Act was that such power should be exercised only when necessary for the proper construction of any proposed railway. The adoption of such plan would not only again require the disturbance of Broadway, but might expose the railway and passengers to great annoyance, if not serious danger, from escaping gas and steam; it was open also to the objection of greater noise and possibly inferior ventilation. The double deck plan moreover burdened the enterprise with the heavy additional expense of pipe galleries and removal of pipes. Another and most serious question which the Commission was obliged to consider was facility of movement between the different tracks in emergencies causing congestion and delay. No system of rapid transit would be complete that did not provide on its main trunk line at numerous points for the movement of trains from either track to any other, and the transfer of passengers from disabled trains, if need be, at any point between stations. This in the double deck plan could be but partially accomplished, while with four tracks on one level the entire blockade of the system would be almost an impossibility. So important is this consideration that the Commission would be loth to recommend any plan wanting in this feature. It would have been regarded as essential even had the Commission adopted a plan for a tunnel at greater depth than the one now reported.

The Commission, after weighing carefully all these considerations, together with the recommendations of its own engineers and of the consulting engineers, and the various suggestions presented to it, thereupon determined, by unanimous vote, on the 19th day of October, 1891, that the route or routes and general plan of construction of a rapid transit railway for the conveyance and transportation of persons and property should be established in this city, as follows:

A route, . . . under Whitehall street and Battery Park and State street, respectively, forming a loop line, the tracks converging to parallelism at a point under Broadway between Bowling Green and Morris street; thence under Broadway and Union square to Fifty-ninth street; thence under the Boulevard to 121st street; thence by viaduct to 134th street; thence under the Boulevard to the south line of 156th street; thence by viaduct to the north line of 159th street; thence under the Boulevard to 169th street; thence under Eleventh avenue to a point 1,460 ft. north of the centre line of 190th street; thence by a viaduct on the same straight line produced to a point 442 ft. north from the intersection of said straight line with the centre line of the Kingsbridge road. [Thence the line is by viaducts, tunnels, bridges and depressed way to the city limits.—Editor.]

Also, a loop from Broadway, under Mail street, City Hall Park, Park row and Chambers street, and again connecting with the Broadway line.

Also, a route, the centre line, diverging from the Broadway line at or near Fourteenth street, running under Union square to Fourth avenue; thence under Fourth and Park avenues to a point 112.15 ft. north from the north line of Fortieth street; thence [to the north line of Jerome Park].

The general plan of construction of the loop under Battery Park, State and Whitehall streets shall be double track; from the Morris street junction to near Vesey street shall be three parallel tracks on the same level with suitable switches and connections between them; from Vesey street to 190th street on the west side line shall be four parallel tracks on the same level; and thence across the Government Ship Canal and Spuyten Duyvil Creek to the city limits shall be two parallel tracks on the same level. On the east side line from Fourteenth street to the Harlem River shall be four parallel tracks on the same level, and thence to the city limits shall be two parallel tracks on the same level.

The tunnels shall be not less than 11 ft. 6 in. in height in the clear, and 11 ft. in width for each track. Whenever necessary for the proper support of the surface of the street, the roof of the tunnel shall be of iron girders with solid plate iron covering supported by suitable iron columns between each of the tracks, and supporting walls on the outside. The roof of the tunnel shall be as near the surface of the street as the pipes and underground structures now laid therein and the street grades will permit. Viaducts shall be of masonry or iron, or both combined. The Government Ship Canal and the Harlem River shall be crossed by double track drawbridges not less than 50 ft. in the clear above mean high water mark, with clear spans of not less than 125 ft. between the centre piers and bulkhead line. North of the Harlem River the construction shall be by viaduct, depressed structure and tunnel as the grades of the land upon the proposed routes shall require. The junction of the tracks near Fourteenth street shall be effected by dividing them around Union Square, raising one pair and depressing the other, so that trains going in opposite directions shall not cross on the same level. All station approaches shall be as far as possible through private property to be acquired for that purpose, except that on the Boulevard station, approaches may be in the centre of the street.

A footway shall be provided the whole length of the line between the centre tracks, and refuge niches shall be built in the side walls at proper intervals for the convenience and protection of employés.

The motive power shall be electricity, or some other power not requiring combustion within the tunnel; and the motor or motors shall be capable of a uniform speed for long distances of not less than forty miles per hour, exclusive of stops.

The manner of construction from South Ferry to about Thirty-fourth street shall be by underground tunneling without disturbing the surface of the street. In case of necessity the excavations below Beaver street, and in the neighborhood of Canal street, and at such other special points as the commission may, during the progress of work determine, may be made by excavation from the street surface, and all excavations in Fourth avenue above Fourteenth street and in all other streets and avenues above Thirty-fourth street may be made in the same manner. . . .

At Union square, as shown in the accompanying drawings, a system of tracks has been devised by which all trains on the Broadway and Madison avenue line are accommodated at a single station, and all grade crossings between trains in opposite directions are avoided, thus facilitating high speed and eliminating in the best manner possible the dangers and delays incident to such crossings.

At Ninety-sixth street the contour of the ground necessitates the termination of the tunnel. It therefore becomes necessary to deflect the line from Madison avenue and occupy private property, thence to Harlem River, on account of the prohibition in the Rapid Transit act against the use of Madison avenue for an elevated structure.

The stations on the route selected have not been located, for the reason that the board was advised that they constitute part of the detailed plans which the commission are required to complete after the general plan shall have received the approval of your honorable body.

Detailed plans and specifications for the construction of the railway, including stations, devices and appurtenances deemed necessary to secure the greatest efficiency, public convenience and safety, will be prepared by the commission, in accordance with the provisions of the act, if this report is approved.

The Commission make no recommendations as to the method of construction. These matters the Commission will deem it wise to leave, so far as permitted by the act, to the judgment of the purchaser, subject always, as the act requires, to the control of the Board. The particular shield, if any, to be used in excavating under the streets, the details as to materials and form of walls and other interior surface should, as far as consistent with the requirements of the act, be subject to his selection. Any attempted determination of the method of construction in advance might narrow the field of possible competition to such an extent as to endanger the success of the enterprise.

When the Commission decided to adopt an underground route it also decided that the motive power must be secured without combustion in the tunnel. While the Board is convinced that electricity as a motive power is available for the purposes of the railway recommended by this report, it is not deemed wise at the present time to exclude other forms of power answering the essential conditions of speed and non-combustion in the tunnel, or to attempt to direct the exact method of application of such power as shall finally be adopted.

William Steinway,
John H. Starin,
Samuel Spencer,
John H. Inman,
Eugene L. Bushe,
} Commissioners.

Sociology of the Street Railroad.

BY CHARLES H. COOLEY.

The Eleventh Census of the United States will soon present statistics of street railroads which, though by no means of ideal completeness, will furnish more adequate data than we have hitherto had for the study of city transportation from the standpoint of public economy. What is called rapid transit has hitherto been discussed by economists chiefly in connection with other questions and, therefore, in a somewhat one-sided manner. There has been little attempt to search out independently of questions of city finance the principles that govern city transportation. No one has taken up the study for its own sake, placed it upon its own proper basis as a distinct branch of public economy, and given a comprehensive idea of its social significance. It seems that there is need, before going farther to re-examine what we know about street railroad transportation, apart from the questions with which it is usually connected, and see if it is not possible to formulate a more adequate and scientific conception of its social functions. In the light of this we may expect to see more clearly what it does and what it might do, and thus have a firmer foundation from which to advance to more complete knowledge. This paper aims to do something towards satisfying this need.

Beginning with a brief reference to well known facts illustrating the part which street railroads play in city life, I shall attempt, in the first place, to deduce from these and other familiar data a more comprehensive conception of the function of city transportation, second to show the increasing social need of the efficient performance of this function, and finally to point out the various factors upon which efficiency depends.

In a great city the street railroad plays an essential part in the lives of the people; it is to a large and growing class not a luxury but a necessity. The most vital conditions of life vary according to the efficiency with which it does its work. The elevated railroads of New York City carry one-half million passengers a day; the horse and cable railroads of that city 600,000. One hundred thousand daily cross the Brooklyn bridge on the bridge railroad, making in all about 1,200,000 rides per day. Thus the number of rides taken daily is equal to about four-fifths of the entire population of New York City. Supposing that each person takes two rides daily we have 600,000 as the number of persons using the cars. It is certainly well within limits to say that much the greater part of those who earn their bread on lower Manhattan Island could not live where they do and work where they do, without the daily use of the rapid transit railroads. One who takes the elevated road in early morning or immediately after six o'clock in the afternoon finds the trains fairly packed with working men and working women, and having once mixed with the tired, grimy and uncomfortable crowd will not thereafter doubt that rapid transit is not the luxury of the well-to-do but the necessity of rich and poor alike.

In Chicago, city transportation is seen in the full course of its most rapid development. The length of lines in that city has more than doubled during the past 10 years, and I do not doubt that the number of passengers carried has increased in a much greater ratio. Cable and horse lines are built far out into the almost uninhabited prairie in the sure expectation that population will follow the cars. I learned there that in some cases at least an actual decrease of rent in the more thickly settled part of the city had been observed to follow the opening of a new suburban line of cable railroad.

We must, I think, recognize in the systems of urban transportation a definite social organ, having for its function the distribution of population about industrial centres. It is an industrial necessity that men shall work in dense aggregates. It is a human necessity that they should not live in dense aggregates. It is inevitable that the number of aggregated workers should increase not only absolutely but relatively. We have then an irrepressible conflict between the human need, that every man shall have plenty of space to himself and the industrial need that men shall crowd together. The function of the city railroad is to reconcile these conflicting requirements of the social organism. In so far as it is efficient it enables men to work in crowds, and nevertheless to live in decent isolation. It renders the situation of the family, of the women and children, in a measure independent of the place where the head of the family must work. The street railroad then, whether elevated overhead, sunk under ground or placed on the surface of the street, whether operated by horses, cable, electricity or steam locomotives, has always the same function, namely, to distribute population.

All our considerable cities have rapid transit facilities more or less efficient, but in all what has been done is small compared with what must and doubtless will be done to meet the conditions of the future. The fact that cities not only share fully in the general increase of population, but are undergoing a rapid relative increase also, is so familiar that I will not attempt to illustrate it. Of more interest perhaps than anticipations regarding the future size of cities is the fact that the means and methods of passenger transit in cities such as we have are now in course of rapid change. It seems hardly too much to say that the application of electricity to this purpose promises to double the speed of street cars and halve the cost of running them. Cable traction, especially in some of the largest cities, is working an almost equal change. In the cases of electricity, the development already attained has occupied scarcely more than four years. The industries connected with the construction, equipment and operation of electric railroads are developing with a rapidity not equaled, as far as I am aware, in other lines of business, and are widely spoken of as offering a new and promising field for the activity of capital. I believe there is no engineer familiar with the technical features of street railroads who does not look forward to an indefinite increase in almost every factor of efficient operation.

There are certain factors which act in a rather definite way to determine the efficiency with which street railroads perform their function of spreading population. The relations of these factors, arising from the fundamental nature of the problem, are permanent, and any attempt to determine them must, in so far as it is successful, have interest and value. I come, then, to an analysis of some of the factors upon which depends the efficiency of city transportation.

I shall consider chiefly two, the speed of cars and the cost of riding. In order to show the influence of the speed of cars I shall employ a geometrical illustration. For this purpose let us conceive a hypothetical city, and suppose that, for industrial purposes, the working population is daily concentrated at the centre of the city, while their dwellings extend as widely from the centre as the means of getting to and from their work permits. The city, then, may be represented by a circle with a dot at the centre. The circle represents the area in which the people live, the dot the place where they work. I will call this circle the circle available for urban population. As the area of this circle available for urban population is clearly dependent upon the greatest distance from their work at which it is practicable for people to live, and as this last depends upon the rapid transit lines, I may say that the circle represents the total efficiency of rapid transit. The size of this circle determines the average space per inhabitant. That is, for a given population the average amount of space allotted to each inhabitant is directly dependent upon the total space available. The average ration of sunlight, of fresh air, of open space, trees, gardens, parks and lawns varies directly with the area of this circle. The area of this circle depends immediately upon the length of the radius, varying as its square. That is if you make the radius three times as long you make the area of the circle nine times as great. The radius represents the greatest distance from their work at which it is practicable for people to live. If you increase this distance by any factor then the area of the district available for population is increased by the square of that factor. Now supposing the time that men can afford to spend on the cars in going back and forth remains the same, the distance from their work at which they can live varies directly as the speed of the cars. The area of the available circle, then, or the efficiency of rapid transit varies as the square of the speed of the cars.

To illustrate the influence of this one factor, suppose a city of 100,000 families where the cars run at six miles per hour, and the working people daily concentrated at the heart of the city cannot spare more than half an hour in riding to their homes. The radius of the circle will then be three miles, and the average space occupied by each family will be found to be 0.18 acre.

Now suppose that all other things remaining equal, the speed of cars is increased to 18 miles per hour. The radius of the available circle will become nine miles, three times as great as before, and the average space for each family will be nine times as great, or 1.62 acres. In this example I have compared the usual present speed of street cars with a speed not now attained, but by no means impossible.

The second factor of efficiency which I shall consider is the cost of riding. I shall consider the influence of a reduction of fare, first, in bringing a residence in the suburbs within the reach of classes who could not have it before, and second, in effecting a saving in the incomes of those who ride.

It is clear that unless the rate of fare is such that all workingmen can ride, the poorest classes must remain aggregated near the centre of the city, however fast and comfortable the cars may be. It must not be forgotten that the chief social value of rapid transit is in opening to the poorest people possibilities of better living, and no system can be held efficient which does not supply transportation at a minimum cost.

To illustrate the effect of a decrease in fares, I will instance the experience of the elevated roads of New York. Near the end of the year 1886, the fare on these roads, which had hitherto been 10 cents except at certain hours of the day, was reduced to five cents for all hours. The reduction in the average rate of fare thus effected was from 6.38 cents to 5.04, only 1.34 cents, but the statistics of traffic for the following year show a change in the number of passengers carried from 115,000,000 to 159,000,000, or an increase of 44 millions. Deducting the normal yearly increase, which I find to have been about nine millions in the three following years, we have a net increase of 35 million passengers, or about 30 per cent, due wholly to the reduction in fare. This reduction did not affect the early morning and evening hours, and therefore the illustration does not throw so much light as could be wished on the use of the cars by laborers going to and from their work at those hours. It may be presumed, however, that these 35,000,000 passengers were of the poorer sort. I believe that none will question that every reduction in car fare will increase the number riding in a much greater per cent. than the per cent. of reduction, and that those taking advantage of the reduction will be those who must need to ride.

A laborer whose income is $400 a year and who lives so far from his work that he has to ride to and fro, will save over three per cent of his total income by a reduction of fares from five to three cents. I do not take into account the use of cars by any of his family but himself. The sum saved in his fares alone will be about $12.50, which, according to excellent statistical authority, is not far from equal to the sum such a man and his family would spend for boots and shoes.

It may have been noticed that I have scarcely mentioned a class of phenomena which, although secondary and incidental to the spreading of population, must appear to many as of at least equal importance with any I have considered. I mean the influence of rapid transit on rents. This discussion would take me into deeper water than I now care to go, but I am satisfied of the great significance of rapid transit in connection with city rents, and I think that the laws which regulate its influence will yield definite results to careful investigation, but I shall not enter into the matter in this paper.

In conclusion, I wish to point out that from what I have said it follows that the ideal which economists and legislators should have in view in dealing with questions of city transportation is the highest possible efficiency in performance of the function of spreading population. Those who come upon the study of street railroads in connection with questions of municipal finance, may be inclined to look upon these means of transportation too exclusively as a source of municipal revenue. Just and expedient as it doubtless is, that, under present conditions, a considerable part of the revenue of street railroads should be taken by the public through its organization as a city government, I venture to assert that the justification and the expediency are found chiefly in the fact that it is more practicable to secure the benefit in this way than in the form of a reduction of fares. It must not be forgotten that the function of spreading population performed by city railroads is one of co-ordinate importance with any of those performed by the municipal body politic. The ideal condition is one in which all excess of revenue over a minimum cost of operation is taken up by continual reductions of fare and faster and more adequate service. Should street railroads in the future ever be owned by the public, or more immediately controlled than now, they would properly, I think, be regarded as agencies whose service, like that of the post-office, is of such public moment that its cheapness and efficiency must be considered paramount to questions of revenue.

The World's Fair Tower.

Numerous schemes and plans have been proposed and rejected for large structures of various kinds which should be a prominent feature of the World's Fair, bearing a relation to it like that of the Eiffel Tower to the Paris Exhibition. There has finally been brought forward a design for a steel tower, higher than the French structure, and which shall have a capacity for accommodating at one time about four times the number of people. Its construction is now thought to be an assured fact. The plans have been drawn by Mr. George S. Morison, one of the most celebrated bridge engineers of this country, and a company has been formed by which sufficient capital may be raised.

The Keystone Bridge Company, of Pittsburgh, has made offers to erect the tower designed by Mr. Morison, and to contract to have it completed and ready for operation by Feb. 1, 1893, and agrees to pay heavy forfeits for any delay after that date, and expects that it will be finished by Oct. 12, 1892, in which case the company will receive a considerable bonus. Options have been secured on plots of land adjacent to the World's Fair site, and it is the intention to have this extra land placed under the jurisdiction of the "Fair" officials.

The cost of the enterprise is estimated at not over $1,500,000, although the Eiffel Tower with only about one-fourth the capacity, and built with cheaper labor and less cost for steel, cost but a little less than $1,700,000. This saving in expense is due to the greater simplicity in style of construction and to the use of standard sizes and shapes of material in its design, the columns being made up largely of plates and angles.

A conference was held a few days since, of several capitalists, and officials of the Keystone company, when matters were carefully gone over and arrangements set on foot for getting the affair in hand at an early date. Pledges and subscriptions are had from St. Louis, Cincinnati, Pittsburgh and Chicago parties which are nearly sufficient to complete the undertaking.

The Morison Tower will be higher than that of M. Eiffel; from the ground to the top of the flag staff will be 1,120 ft.; from the ground to the focal plane of the lighthouse which surmounts the structure will be 1,070 ft. The size of the base at the foundation level is to be 440 ft. × 440 ft. The first landing will be circular in form at an elevation of 200 ft., having a diameter of 250 ft.; the second, also circular 150 ft. in diameter, and 400 ft. from the ground. The top landing or "lantern," also circular, and 60 ft. in diameter, will be 1,000 ft. above the ground. There will be a colonnade 15 ft. wide surrounding the first landing, which will accommodate 5,000 people at one time, inside of which will be erected four hotels with restaurants, each 45 ft. × 90 ft., of as many stories as may be required, which will be built in appropriate styles of architecture for English, French, German and Spanish, or other class of café. Besides these of course much space will be required for elevators and machinery on each landing, as well as ice rooms, storage, etc., and in addition will be various circular, oval, or octagonal shaped booths or kiosks to be used as shops. Within these cafés or hotels from six to eight thousand persons may be seated and served at once and the spaces about the booths will easily accommodate several thousand more, thus making the capacity of this first landing some 12,000 or 15,000. The second landing will be used as a large promenade and garden. The top lookout will be several stories in height and above this will be four offices, for the signal service, scientific investigation and the engineer of the structure, over which will be various machinery and the lighthouse, provided with revolving lights.

The Moenchenstein Bridge Disaster.

The report on the Mönchenstein bridge disaster in Switzerland last June made to the Civil Court of the city of Basle by the engineers Conradin Zschokke and Leonhard Seiffert, has been published.

The cause of the accident, according to this report, is found entirely in the "defective construction" of the bridge, this apparently embracing also the design. Calculation showed that there was a large number of weak points in the bridge, and at these the material was strained far beyond customary and permissible limits. This was particularly true of the middle diagonals and the end posts.

The theory of derailment of the train while on the bridge is considered as untenable, and a number of reasons, based upon examination of the wreck after the accident are cited to demonstrate that such derailment could not have taken place. A careful examination of the bridge, after the breakdown, failed to show any old fractures or cracks which might have helped to bring about the accident. There was no prominent or dangerous corrosion in any part of the bridge, but the material used was not of that good quality which is usually demanded now. It is to be borne in mind, however, that since 1874—the year in which the bridge was built—the requirements of bridge specifications have become more and more exacting.

The type of the bridge is not criticised adversely in the report, but the workmanship and the proportions adopted for different parts are commented upon severely. The proportions were in accordance with those prescribed in the plans and specifications.

As to the inspection of the bridge Messrs. Zschokke and Seiffert are of the opinion that the damage caused by the floods of 1881 should have prompted the necessity of carefully watching the bridge after it had been repaired, more particularly because shortly after that time the train speeds were increased on the road and heavier locomotives were introduced. Both the higher speeds and heavier loads were supposed to have been satisfactorily provided for by strengthening the bridge at several points, as illustrated and described in the *Railroad Gazette* of July 17, 1891, but no data have been available as to the proof loads, if any, subsequently applied. The fact is criticised also in the report, that the strengthening of the bridge was confined to the cross girder connections and other parts on the track level and was not extended to many weak points that ought to have received attention.

The maintenance of this bridge is considered to have been all that was called for by good practice.

It will be seen from this that the conclusion already generally accepted as to the primary cause of the breakdown, viz., defective design and construction, was not without a good basis; forthcoming additional expert reports will, it is thought, add further weight to it.

Railroad Exhibition at New Haven.

The Independent Order of Railway Conductors, Division No. 1, of New Haven, Conn., held a fair in that city last week (continuing six days and evenings), which, although local in its general character, included a number of interesting exhibits of railroad wares which are briefly described hereunder. The fair was very successful, and was visited by a good many railroad officers, as well as by many thousands of the general public.

The railroad exhibits were:

Consolidated Car Heating Co., Albany, N. Y: Miniature locomotive in running order with one car showing the double disc system, in use on the New York, New Haven & Hartford. Also models showing the company's various systems as exhibited at the Cape May Conventions. The engine model is the first locomotive built in Chicago.

Wakefield Rattan Co., Boston.: Four styles of car seats upholstered in plush and rattan with high and standard backs. One seat is of an entirely new pattern, invented by Mr. F. H. Henry. It has low arms and is upholstered in plush. The back instead of reversing swings from front to back, thus bringing the wear about equally on both sides of the back. This seat has Henry's new all-metal springs.

Fred Enos, Bridgeport, Ct.: Full size model of end of freight car equipped with vertical plane M. C. B. type coupler.

Peck, Stow & Wilcox, Southington, Conn.: Samples of monkey wrenches.

Ramapo Iron Works, Hillburn, N. Y.: Model of automatic switch stand, switches and frogs and the Ross-Meehan brake shoe, with test cards from several roads showing advantages from the use of this shoe.

Ramapo Wheel & Foundry Co., Ramapo, N. Y.: A full size W. W. Snow's boltless steel-tired wheel with a section cut out showing the manner of construction.

Smith Friction Drill & Tool Co., Boston: Various sizes of the Smith friction drill for track work, machinists, boiler makers, bridge builders, etc.

National Surface Guard Co., Chicago: Model of steel surface cattle guard in position on a track.

W. F. Ellis, 620 Atlantic avenue, Boston: Samples of the Goldie spike. Also a miscellaneous exhibit of samples of rails in use on most of the New England roads together with spikes and nut locks of various patterns. Also Servis tie plate, Nevins flange scraper and Tallman's flag holder. Mr. Ellis, in connection with Mr. F. W. Snow, was in charge of the Ramapo exhibits, and he also represented the Smith Friction Drill & Tool Co., The National Surface Guard Co. and Dilworth, Porter & Co., Limited.

Kelsey Railroad Signal Co., Florence, Mass.: Full size Kelsey gong signal, 3-lever interlocking machine with double wire compensator, switch and lock movement with facing point, lock and detector bar; all in working order.

Bryant & Farbey, agents of the Bryant Sawing Machine Co., Boston: The Bryant Portable Rail Saw in working order. Exhibition cuts were made with this saw, a 72-lb. rail being cut in 7 minutes, and the same rail on an angle in 9 minutes.

H. A. Williams Mfg. Co., Boston.: Samples of steel and brass railroad oilers and torches.

Weber Railway Joint Mfg. Co., 74 Fifth Ave., New York City: Models and full size samples of the Weber rail joint.

Safety Car Heating & Lighting Co., 160 Broadway, New York: Three Pintsch lamps, arranged for lighting, in a model of a passenger car; two with compressed, the other with city gas, to show difference in illuminating power of oil and coal gas.

The Hall Signal Company, New York and Chicago: Full size automatic electric block signals in operation, both wire circuit and track circuit; also highway crossing bell signals, interlocked train signal for crossing gates and the Stewart-Hall train-order signal.

Union Switch and Signal Co., Pittsburg, Pa.: Drawings and blue prints of the pneumatic interlocking and block system and other apparatus of this company.

American Automatic Lighting Co., New York: Kerosene lamps for railroad stations and passenger cars.

Dressel Railway Lamp Works, New York: Samples of Dressel signal and tail end lamps.

MacKenzie & MacArthur, New Haven, Ct.: Samples of compression shaft couplings.

Stanley Rule & Level Co., New Britain, Conn.: Samples of levels, rules, small tools and other goods of their manufacture.

Russell & Erwin Mfg. Co., New Britain, Conn.: Full size passenger car door and frame equipped with the Home door check and spring. Samples of bronze metal door knobs, locks, escutcheons, etc.

Lane Mfg. Co., Waterbury, Conn.: The Mansfield improved fire extinguisher.

R. T. White, New York: Model of the White elevated railroad.

Denison Lubricator Co., New London, Conn.: Samples of the Denison patent improved cooling and lubricating compound.

Rich Electric Heating Co., Mount Vernon, N. Y.—The Rich electric heater for street cars; also electric lighting, heating and ventilating system for steam cars.

Manning, Maxwell & Moore, agents Ashcroft Mfg. Co. and Consolidated Safety Valve Co., 111 Liberty street, New York: Samples of steam gauges, valves, Tabor's improved engine indicator, Metropolitan automatic injectors, etc.; also Smith's portable rail saw.

Continuous Rail Joint Co. of America, Newark, N. J.: Samples of the "continuous joint rail."

National Lock Washer Co., Newark, N. J.: Samples of the National nut lock.

The E.S. Greeley & Co., 5 and 7 Dey street, New York: Samples of oil cans, lamps, journal bearings and telegraph instruments; the Davies spring nut lock, Kalamazoo hand car, Beland's ratchet track drill, Wood's car-box lubricator, Buda track level, New York Car Wheel Co.'s machined car wheel, Champion track jack, Verona nut lock and track tools, and a variety of car trimmings and signal and conductor's lanterns.

The railroad supply exhibitors presented to Frank A. Hermance, general manager of the exhibition, a testimonial consisting of a gold badge suitably inscribed, and to John McCarthy, assistant manager, a handsome lamp.

Bursting of a Flywheel at the Amoskeag Mills.

A flywheel of 60 ft. diameter and 9 ft. face burst recently at the Amoskeag Mills, Manchester, N. H., resulting in the death of six employés, fatal injury to six more and from 15 to 20 more or less badly injured. The flywheel revolved at a normal speed of 60 revolutions per minute, carrying some 2,000 H. P. The calculated speed of the periphery or face at a radius distance of 30 ft. from the centre of motion of the wheel at a normal speed of 60 revolutions per minute is 11309.76 ft. per minute, about 2.142 miles per minute and 128.52 miles per hour. Comment as to the carefulness with which such flywheels should be designed and built is unnecessary. Mills 4, 5, 7 and 8 are now at a standstill. The engine was of the Corliss type.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Mr. Wattson's excellent paper on train service management which was published (on page 728) in our last issue was unfortunately printed without the name of the author, though the information was properly given on page 720. The article is, however, well worth attention on its merits, and those who looked at it doubtless read it through. It is to be hoped that the discussions suggested will be taken up. Those who disagree with Mr. Wattson as to the expediency of issuing a printed time table for a special passenger train ought to give their reasons and try to convince him of his error. Those who find it impossible to educate their trainmen to "watch the ventilation of passenger cars closely and intelligently" should find out how he does it. The question whether freight trains should be so long that they almost stall the engine at every considerable ascent or should be of such size that the engineer can uniformly make time is really a far-reaching one; and those who have carefully balanced the results could help many another superintendent by publishing their experience. A Western superintendent who never pays overtime to any of his 75 freight train crews keeps the men from complaining by so adjusting his schedules and his train loads that trains are rarely very late. Such a result as that is worth working for, and Mr. Wattson suggests one of the ways to go about it.

The importance of Mr. Wattson's words about block signaling was pointed out last week. His figures of the cost are interesting. The block signal equipment for 128 miles of double track and 13 miles of single track cost $3,364.75. Taking 15 per cent. per annum for interest and depreciation, the annual charge for this item amounts to about $500. The extra yearly cost for operators is $3,360. The wages account for maintenance must be very little; but if we take the total annual charge, for this and the above items, as $4,000, we have 5 per cent. on a capital of $80,000. Whether or not it is worth while to invest this sum to get the immunity from accidents and the facility of traffic movement which the block system gives, every operating officer can judge. Another topic which alone affords material for an hour's discussion is that concerning superintendents who prowl around nights, and still another is that concerning the adjustment of the force of trainmen to the needs of busy and of dull seasons. The ideal superintendent must know how his men conduct themselves, and if the men work nights he must do likewise. With human nature as it is work must be inspected when the workers do not expect it, and this justifies the course Mr. Wattson has referred to. Superintendents who sit in the office, and wait for wrong doers to come in and report themselves, say that it is unfair and even dishonorable to pounce upon men like a sneaking spy. The fact would seem to be that the more a superintendent knows about the details of his business and the more familiar he is with the nocturnal habits of his men, the better service he will get. The right man will increase the respect that his men have for him and their confidence in him by frequent observation of their work. The man whose dignity and authority suffer from actual contact with his subordinates is not very good material for a railroad superintendent. One of the most successful and respected managers that we know of is in the constant habit of making nightly visits to his yards, shops and stations.

The pith of the other question referred to is, Can a company afford to keep, during the dull season, a good number of brakemen who, when a rush comes on, can at once become conductors and safely run trains with one or two green brakemen? We use the term "green" advisedly, for the "floater" is little better than the best men obtainable from other quarters. Brakemen intelligent enough for conductors must be paid more than is required to retain men barely qualified to brake; and to keep the whole force of brakemen up to such a standard that every man can be put on the tail end at a moment's notice will also entail some additional expense; will the general manager allow this? If he will not, he (or his superior) is simply choosing to take the inevitable risk that arises when the time comes to increase the force. The division superintendent can do little to change this state of affairs, for he cannot prove in advance how many dollars will be saved by having first class instead of ordinary men to handle trains six months in the future; but it is worth noting that a system of examining and grading the men and giving them certificates, as is already done with enginemen in many cases, is one of the best preliminaries to getting larger appropriations. Men are kept on the road by other influences than the mere pay, and a brakeman who has definite knowledge that he is regarded as fit to run a train is less likely to leave and more likely to put forth his best efforts than one whose prospects and tenure are doubtful. Good men, doing their best, will certainly show good results, and that will tend to make the money-power of the road willing to pay higher wages. A prominent general manager said, recently, that safety could be secured up to a certain point, and beyond that some risks must be taken, unless the traffic should be allowed to suffer; which was another way of saying that the elimination of those risks involved more expense than he dared incur. This dictum applies to the case of the brakemen which we are now considering; but it is important to note that in this matter, as in other high trusts, it is impossible to find and follow the precise limits of safety. The president who has just been deposed for malfeasance in office is now being told that he should have avoided the very appearance of evil; should have given the company more than its due rather than even seem to defraud it. Lower officers are bound by the same principle. The superintendent who would protect the lives of passengers and employés, and use the company's property with economy, must not merely get men who seem to come up to the standard; he wants those who will easily grade above the standard. To certainly get *to* the safety line, he must go beyond it.

In our issue of Sept. 18 we published the particulars of three very remarkable fast runs, viz., the New York Central, 436⅛ miles at 59 56 miles per hour including stops and 61.56 miles per hour in motion: the China mail train over the same road and the R. W. & O., 361 miles at 51.81 miles an hour including stops, and 55.96 in motion; and finally the run on the Reading of 12 miles at the rate of 82.7 miles an hour. In this last run two consecutive miles were made in 40 seconds and 39⅘ seconds respectively, or at the rate of 90 miles and 90.5 miles. This last record has been questioned. It has been suggested that there were errors in timing, and that the miles might be short. We believe, from careful inquiry, that there was no appreciable error in either particular. Mr. Paxson informs us that he is satisfied that the timing was accurate, and he has investigated the method and the record carefully. A locomotive expert of the first rank, who has often made trial runs over the same ground, and has walked over the track where the fastest time was made and counted the rails, assures us that there can be no doubt that the mile posts are actually a mile apart. It must be remembered that these two miles were made on descending grades of 10.56 and 36.96 ft. per mile. Still another fast run was noted in our issue of Oct. 9. A "Royal Blue" line train on the Baltimore & Ohio, consisting of four cars hauled by Baldwin engine No. 853, ran from Canton, near Baltimore, to Philadelphia, 91.6 miles, in 92 minutes, *including* four stops. In this case no preparation had been made, as the run was made in an emergency arising from a fire alongside the Locust Point ferry slip. Until now the regular schedule time of these latter trains has been the fastest in the world for the distance, being slightly better than that of the London-Edinburgh regular trains. The New York Central now announces a new train, the "Empire State Express," to run from New York to Buffalo in eight hours forty minutes, making four stops. The distance is 439.58 miles. The inclusive speed is therefore 50.7 miles an hour. The speed in motion, however, is, we are told, to be 52.33 miles an hour. So far as we know, this will be the fastest regular train in the world for the distance.

The report of the Committee on train rules, which was only partially covered in our account of the American Railway Association last week, shows that a chief duty of the Committee is to suppress a good share of the questions that are presented to it—or rather to answer them by letter. An appreciable portion of the space taken by the report is given to questions that no one but an apprentice is warranted in asking. Another question—that concerning the time at which a train running ten minutes late under Form E may arrive at a station where no arriving time is given—is easily enough answered, but at the same time brings out in a forcible manner the insufficiency of rules 21 and 92, and the need of showing in the time table both the arriving and the leaving time at every station where a train stops. The inquiry sent to the committee says it is "generally understood that a train is due to reach the next station as soon as it can get there after lawfully leaving the preceding station"; but what reason is there in such an indefinite understanding? Men who reason on this line generally carry the absurdity a notch further, and when pressed for a rule by which the time a train will require may be estimated, will say that it is due to arrive at B the same time that it leaves A. Thus a freight train running 15 miles an hour from A to B, 15 miles, is due at B an hour before it arrives there, provided it is not timed at any point between. This is a safe rule; but who can enforce discipline under such a slipshod plan? The Committee tells an inquirer that a train running under Form G 2 should not carry white signals; but this was already apparent, in the official issue of the code, from the first half dozen words explaining the example under this form.

The Old Farmer's Almanac reminds us that "about this time" the thrifty railroad man is thinking about snow plows, and if he is a thrifty man he is not beguiled into a false sense of security because his road is situated in the Southern States, or because the climate is changing and the winters growing milder. The man in the far Northwest is apt to think slightingly of the troubles from snow of railroads in the East and South, but the record of experience will show him that Virginia, Texas and New Mexico are not free from them. It happened last December that no trains from the East reached Charleston, W. Va., on the Chesapeake & Ohio, for 37 hours, on account of a snow blockade. The Central branch of the Union Pacific, in Kansas, was blocked some eight days last January, and again, for less time, in March. The Atchison, Topeka & Santa Fe was blocked on its main line in Kansas for about five days. In November, 1889, two passenger trains were snowbound for a week on the Denver, Texas & Fort Worth, in New Mexico, and Nov. 8 a snowstorm was reported from Dayton, N. M., as raging seven days. The more or less widespread notion that our winters are growing milder is quickly shown to be erroneous when one applies statistics to it. The records of New York showing the average temperature for the months of January, February and March for the past 20 years, and the same average for the past 63 years, as reported at the meteorological observatory in Central Park, show a variation of these averages of but 0.8 degree for the two periods, the average for 20 years being that much lower than that for 63 years. The necessity for an efficient snow plow has therefore not diminished with time, nor is it confined to any locality, and it is not surprising that inventors are active in their efforts to meet this necessity. Not less than 280 patents have been taken out in the United States in the last 30 years, but probably not a dozen of these have ever been actually built and tried in snow. They include devices to plow the snow, to melt it, to explode cartridges in a snow bank, to remove it with knives and spoons and buckets and wheels. Some of these have proved more or less efficient in service, especially those styles now familiar in the northwest, which are invaluable in their field. But as long as a machine plow is too costly for roads which are afflicted with only one snowstorm a year, and as it is so expensive to operate that even those roads owning one deem it expedient to use a common plow in dealing with snow of moderate depth, the old-fashioned method must remain much the most common, and improvements in the details of push plows will interest a great many operating and mechanical

officers. We give considerable space therefore in this issue to a snow plow which has some novel and valuable features, and which has given good results in service.

The New York Rapid Transit Report.

The report of the Rapid Transit Commissioners of New York, which bears date of Oct. 20 and was given to the public Wednesday, is essentially what was expected from the time the reports of the consulting engineers were made known. There was little doubt that one of the shallow tunnel schemes would be accepted, and the question was pretty well narrowed to the Worthen or the Parsons plans. To our readers, therefore, the chief interest will, we suppose, lie in the statement of the reasons, which decided between overhead and underground construction, and between deep and shallow tunnels.

These reasons are presented almost too concisely. They must be read carefully and expanded by the reader's own knowledge and judgment to have their full weight. Perhaps this is no defect in the report for engineers, but in a document designed for the general public it is, we judge, a serious defect. The weight of many of the arguments will not be realized from the bald statement that is made. There is some advantage, however, in a document so short that it will be read through.

There is another minor criticism to make on the report. It outlines an engineering work of great magnitude, in point of cost greater than any that has ever been undertaken in America. It is very largely the result of the studies, labors and suggestions of the engineers of the Commission. Yet the names of these engineers do not appear from one cover to the other. Perhaps Mr. Worthen and Mr. Parsons asked that they should not be mentioned by name. Perhaps there is some propriety in the matter that we have not been educated up to; but to many engineers who read the report the omission will seem unusual at least, particularly as the Commissioners, their counsel and the consulting engineers, appear in due form.

The report itself is in the main wise. We do not presume to say that it offers the best possible solution of what we have said before is an engineering problem of the first magnitude; but it is a judicious compromise and is an adequate and comprehensive solution. That is, if the railroad can be built as here proposed, it will answer for the needs of the city for a great many years; it will be far cheaper to build than a viaduct through private property, and it has a better chance of earning interest on the investment than a deep tunnel. When we say if the railroad can be built we mean if capital can be got to build it. The mere work of construction on the plan laid down in a general way by Mr. Worthen and Mr. Buck can probably be carried out within reasonable limits of cost and with sufficient security. How cheaply and how safely the tunnels can be carried up lower Broadway with the shield proposed will depend on the chief engineer of construction; but he will need to be a man of judgment and expedients, for he will have more emergencies than precedents. One of the deciding points between the Worthen and the Parsons plan was the greater cost of the latter. It would be interesting to know what the difference would be. It may be that the Commissioners have sacrificed the immense advantage of disposing forever of the pipes under Broadway for a pretty small immediate economy. This question of taking care of the pipes will have to be taken up some day, and until it is taken up the public will continue to "pay through the nose."

But we did not set out to compare possible plans. This is not the time. The matter now passes to another stage and the next step may be a tedious one. The consent of the majority of the property owners must now be got. When that is done, or when in lieu of it the necessary authority of the court is had, the franchise will be offered to investors. Then will come the real test of all that has been done. Ninety million dollars is a good deal of money to venture, even on railroads for the city of New York, but the scheme now laid out may easily cost that, and *may* cost more. So we conclude that the matter is still far from settled.

Means for Increasing Locomotive Cylinder Power at Speed.

On the Northwest System of the Pennsylvania Lines some very important experiments are being made on the value of different sizes of steam ports and different arrangements of smoke boxes. A large number of indicator cards have been taken showing the exact performance of the passenger engines as they are now built. These are to be compared with the results to be obtained from new cylinders having long ports and valves having the Allen auxiliary port. The object is to decrease the wire drawing on the admission line of the indicator card and to prolong the point of compression nearer to the end of the stroke.

Of course, those who are familiar with all that has been written regarding the serious losses in power and economy of locomotives at high speeds, resulting from the wire drawing and excessive compression, will understand the value of these investigations. If a comparatively slight change can be made in the indicator cards as the result of these changes in the cylinders and valves there will be a decided gain in the "smartness" of the engine. Nearly all express locomotives are "logy" at high speed. If it were not for the fact that the train is moving rapidly, this would be much more noticeable than it is. A 10 per cent. increase in the area of an indicator card means 10 per cent. more power in the locomotive cylinders. This, at a high speed, would produce a wonderful change in the action of a locomotive. Every locomotive running on a passenger train often reaches its maximum cylinder power at high speeds, and there is little margin for the engineer to work in to keep to schedule time. For fast express work it is useless to increase the weight of locomotives unless the cylinder power is increased, and, as any one can see who will take the trouble to lay out the diagrams, it is fruitless, or nearly so, to attempt to increase the cylinder power in any other way than by an improvement in the valve motion. Of course, a radical step would be to change the Stephenson link to another and better form of gear, but there are many practical difficulties, and as there are other ways of reaching the same result without changing the Stephenson gear, it is better that these other ways should be followed first.

The favorite way, and in fact the customary one, of increasing the power of locomotives at speed, is to give to the cylinders longer ports, with the design of obtaining an increased area of port opening at short cut-offs; but this does not reduce in an appreciable degree the amount of compression, which is the larger of the two evils—excessive wire drawing and compression. Now, while it is difficult to point to records showing beyond question that increasing the length of the ports of locomotive cylinders does not increase the power of the engine as much as is generally considered, yet such records as there are and such personal experience as is available, all tend to show that an increase of the length of the port does not produce the desired result. Not a few of the long port locomotives have been changed to have shorter ones, owing to the difficulty of keeping up the link motion, to the trouble incident to the balancing of the valve, and to the breakage of valve yokes and stems. We know of one case where a valve used with 20-inch ports was not balanced. As a result the valve seats and valves were cut beyond reason, and it was nearly impossible to keep the valve stems and yokes from breaking.

Undoubtedly, increasing the length of the port has some beneficial effect. The addition of the Allen auxiliary port ought, according to the areas of the passages through which the steam passes, to give a decidedly increased power to the locomotive by reducing the wire drawing on the admission line. This auxiliary port does not materially affect the compression, and only tends to remove one of the evils. The long and short port discussion has been continued since the early days of locomotive building, and the prolonged dispute regarding this which took place on the Boston & Albany road some 20 years ago is a matter of history. There an exceedingly short port was made to show about the same results as a long one. Just how this was accomplished is not known.

Probably the most decided step which has yet been taken with a view of increasing the power of locomotives at high speed was made by Mr. Paxson, Superintendent of Motive Power of the Reading, several years since. It was the result of a very decided demand for faster time on that road. Careful tests and analyses showed that the whole reason for the lack of power at high speed was the small mean effective pressure in the cylinders. By diagrams and by link motion models, it was proved that more advantage could be obtained by increasing the travel of the valves and the outside lap than by increasing the length of the ports. As a result of these researches, engines were built with 7-in. travel and long outside lap and put into service. The effect was just what was anticipated. The engines had an enormously increased power—nearly 25 per cent., with the same steam pressure, cylinders and ports, and to-day the Reading road is using a longer valve travel and wider outside lap than any other road in this country.

In 1884 and 1885 the Rhode Island Locomotive Works, without knowledge of the experiments made by the Reading road, began investigating this subject. At that time they were building the modern heavy engine with about the same valve motion as the old Mason engine. It was the valve motion which was commonly used throughout this country at that time; but the locomotives being heavier and having more work to do with the same sized cylinders at high speeds, were not as satisfactory as the old Mason engines, and on such Eastern roads as the Boston & Providence and Providence & Worcester the Mason engine could make better time and had the reputation of being "smarter." The investigation made by the Rhode Island people consisted in an analysis of a large variety of valve motions by means of a full sized model. A man was employed for a long time to do nothing but make records from this model. Diagrams were made showing the amount of port opening and the point of compression for a large variety of combinations of valve travel and outside lap. The result was a complete change in the design of the Rhode Island engines, and to-day they are building and advocating longer valve travel and more outside lap than any other locomotive builders in this country. Engines of this sort built for the New York, Providence & Boston fast trains, for the Cincinnati Southern, and several other roads, have been so successful as to have converted a considerable number of master mechanics to longer travel and increased outside lap.

To emphasize the meaning of these results, we will give a few figures. At a 6-in. cut-off the ordinary valve motion, as commonly used, will give a port opening $\frac{5}{16}$ of an inch wide, and this is all of the total width of the port which is available to admit steam into locomotive cylinders at high speeds when it is most needed. The new proportions of travel and lap that are used by the Rhode Island Locomotive Works and by the Reading increase this opening to $\frac{7}{16}$ of an inch, which is a gain of 40 per cent. in actual area. If it were correct to simply compare the areas, then it might be said that this change of travel and lap would produce the same result that would be obtained if an 18-in. port was increased to 25 in. in length; but it is not fair to compare the areas only, any more than it would be to compare the conducting power for steam or air of six 1-in. pipes with a single pipe having an equivalent area.

Any one who cares to look up this comparison of areas and the effectiveness of areas of ports will find valuable information in a pamphlet published by the Sturtevant Blower Manufacturing Company, of Boston, which describes many experiments relating to the resistance to the flow of air through pipes at a high velocity. These experiments show that a single opening of a given area is vastly more effective to conduct steam or air than the same area divided into small separate apertures. It is evident that a long, thin opening will not carry the same amount of steam that a wider and shorter opening will when of the same area; or if two openings have the same area, the one which has the width and length more nearly the same will carry the larger amount of steam in a given time and at a given pressure.

As locomotives are now built only a fraction of the total weight is utilized at speeds above 40 miles per hour. Hence, an increased weight is not necessary to pull heavy trains at high speeds after they have attained speed; also there is sufficient steam capacity in the ordinary locomotive to furnish the steam required to do heavy express work. The only means we have, then, of increasing the power of express locomotives at speed is to increase the mean effective pressure in the cylinders. To do this there is no surer way than to increase the outside lap and the travel of the valve: but it must be acknowledged that an increase in the length of the port has some good effect on the admission line, and there is no good reason why the admission should not be made more perfect by the use of the Allen auxiliary port, provided it is made wide enough through the body of the valve.

September Accidents.

Our record of train accidents in September, given in this number, includes 139 collisions, 92 derailments and six other accidents, a total of 237 accidents, in which 65 persons were killed and 198 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

Collisions:	Rear.	Butting.	Crossing and other.	Tot'l.
Trains breaking in two	13	..	..	13
Misplaced switch	5	2	2	9
Failure to give or observe signal.	12	2	5	19
Mistake in giving or understanding orders	1	9	1	11
Miscellaneous	13	8	8	29
Unexplained	22	11	25	58
Total	66	32	41	139

DERAILMENTS:			
Broken rail	1	Broken car	1
Loose or spread rail	4	Misplaced switch	13
Broken bridge	2	Bad switching	1
Defective switch	2	Careless running	3
Defective frog	1	Animals on track	5
Broken wheel	4	Landslide	1
Broken axle	6	Accidental obstruction	3
Broken truck	4	Malicious obstruction	2
Fallen brakebeam	2	Unexplained	32
Broken coupling or drawbar	4		92
Burst hose	1		
OTHER ACCIDENTS:			
Boiler explosion	1		
Cylinder explosion	2		
Broken side rod	1		
Cars burned while running	2		
	6		
Total number of accidents	237		

A general classification shows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.	P.c.
Defects of road	..	10	..	10	4
Defects of equipment	13	22	4	39	16
Negligence in operating	68	17	2	87	37
Unforeseen obstructions	..	11	..	11	5
Unexplained	58	32	..	90	38
Total	139	92	6	237	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.
Passenger	47	23	5	75
Freight and other	211	69	1	281
Total	258	92	6	356

The casualties may be divided as follows:

	Collisions.	Derailments.	Other accidents.	Total.
KILLED:				
Employés	34	17	3	54
Passengers	4	2	..	6
Others	4	1	..	5
Total	42	20	3	65
INJURED:				
Employés	63	31	1	95
Passengers	43	52	..	95
Others	8	..	..	8
Total	114	83	1	198

The casualties to passengers and employés, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road	1	19	2	1
Defects of equipment	...	8	4	4
Negligence in operating	5	50	36	70
Unforeseen obstructions and maliciousness	..	..	7	5
Unexplained	..	18	5	15
Total	6	95	54	95

Thirty-eight accidents caused the death of one or more persons each, and 45 caused injury but not death, leaving 154 (65 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with September of the previous four years shows:

	1891.	1890.	1889.	1888.	1887.
Collisions	139	124	71	68	83
Derailments	92	120	59	57	63
Other accidents	6	10	2	3	4
Total "	237	254	132	128	150
Employés killed	54	73	26	29	52
Others "	11	54	20	17	9
Employés injured	95	164	77	65	131
Others "	103	174	85	158	60
Passenger trains involved	75	87	51	42	65
Average per day:					
Accidents	7.90	8.47	4.40	4.20	5.00
Killed	2.16	4.23	1.53	1.10	2.03
Injured	6.60	11.26	5.40	7.40	6.37
Average per accident:					
Killed	0.252	0.500	0.348	0.360	0.407
Injured	0.770	1.330	1.227	1.742	1.237

The most fatal accident of the month was the rear collision near Zelienople, Pa., on the 24th, where seven Italian laborers were killed. It would seem from the account that there was time for these men to escape to a safe distance from the track if they had more fully realized their position. Perhaps the most exciting accident of the month was that on the narrow gauge road at Beaver Brook, Col., on the 13th, where a train containing about 700 passengers was derailed, some of the cars being thrown down a bank and falling into a river. The precise cause of this serious derailment is not apparent, but the semi-official explanation that was published would seem to indicate a lack of the ordinary care required in running long and top-heavy cars on a narrow gauge track. We have heard of curves so short that it was necessary, with wood-burning locomotives, to provide crooked sticks for the fire, but never before heard of one that required the cars to be bent. A baggage car can hardly be blamed for protesting against such treatment.

Passengers were killed in September at Dennison, Arizona on the 1st; Pickerell, Neb., on the 10th; Girard, Cal., the 15th; Plantersville, Tex., the 23d and at Kent, O., on the 30th. The collision at Girard was not owing to a defect in the air brake as reported, but to inefficient signaling, though it seems that negligence of the men in charge of the brakes was a definite though secondary cause. The freight crew whose gross negligence caused the bad collision at Kent were evidently all asleep on their train, though it is said that they had not worked excessive hours and had had ample time for rest before starting out. The Ohio State railroad inspector has reported on this collision, finding gross negligence as just stated, and recommending a block system; but it does not appear whether the road requires passenger engineers to blow the whistle to call attention to signals carried, nor whether, if they give this whistle signal, they must get an acknowledgment of it.

The derailment of a freight train at Caney, Tex., on the 29th, in consequence of the automatic application of air brakes on the front portion of the train, is a novel item in the record, only one or two cases of the kind having come to our notice before; but it is evident from well known conditions that this class of accidents is more likely to increase than to decrease during the next few years. A rear collision of freight trains at New Waterford, O., on the 24th, was occasioned, though not caused, by the unexpected application of air brakes in consequence of the train pipe working loose from its fastenings. The serious collision at Smyrna, Ga., on the 23d would in all probability have been averted, it is said, if the misplaced switch had been lighted.

A passenger train struck an electric street car at Canton, O., on the 12th, fatally injuring the conductor of the car. He was the only person upon it. A similar accident, which injured only one person, happened in Jersey City on the 14th. At St. Paul, on the night of the 19th, there was a collision on the St. Paul-Minneapolis electric street line by which three persons were badly injured and seven others less seriously. Attempts at train wrecking were more than usually numerous in September. Three villains were tried and sentenced to ten years' imprisonment each, as has already been noted in these columns. At Akron, O., on the night of the 23d, some men who were lying in ambush to detect thieves caught some would-be train wreckers in the act of putting ties on the track of the Cleveland, Akron & Columbus road. At Elkton, Md., on the night of the 17th, a brakeman sent ahead to flag on the opposite track went to sleep on his own track and was badly injured by the engine of his own train.

Eastbound shipments by rail from Chicago continue to foot up very moderate weekly totals, and the press dispatches say that the railroads are discouraged. The reporters probably find this feeling among the roads west of Chicago rather than among the Eastern lines, and there is probably ground enough for it, as far as business through Chicago is concerned; though the tendency of grain to go East by direct routes south of Chicago, which that city has complained of lately, is very likely responsible for some of the shrinkage. The statistics of grain receipts at Chicago confirm, as far as they are pertinent, the statement that the roads are not pressed with freight business, though the special activity in old corn this year has so changed the relative importance of corn and wheat shipments from different sections that no detailed deductions can be made that are of value. The shipments by lake from Chicago the past month have been nearly double those for the same period last year, while the rail shipments have been about 20 per cent. less than last year. As long as vessels are so plenty the railroads ought to view with considerable complacency the present slow movement of grain, for nothing has occurred to seriously weaken the conviction that large quantities of corn and wheat must be moved to the seaboard before spring. The Chicago roads apparently have a more definite cause for anxiety in the rumors that rates via St. Louis are likely to be reduced so as to seriously impair the net revenues that might otherwise be obtained on the large shipments that are sure to be offered.

The Chicago City Council has taken a serious step in ordering the Corporation Counsel to prepare an ordinance requiring all of the railroads in the city limits to elevate their tracks 14 ft. above the street level. We have before referred to this as being likely to occur in view of the recent report made by the committee which has been investigating the elevated roads in the East. The matter first came to the front on the proposition of the Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific railroad companies to elevate their tracks 7 ft. if the city would depress its crossings 7 ft. also. This proposition was made last spring and referred to the Railroad Committee of the Council. This committee asked Corporation Counsel Miller in June for an opinion on two points: The power of the city to require railroads to elevate their tracks; and the power to compel the railroads to conform their tracks to the grade of street crossings. The committee at that time thought that if the city had power to compel the railroads to conform their tracks to grade, they could compel them to elevate them if need be. This they thought could be attained, if not by the abstract right to compel them to do so, at least by making it cheaper for the roads to elevate their tracks than to conform to the grade. The Corporation Counsel's opinion was to the effect that the city could compel the roads to elevate their tracks wholly above the streets, and also compel the railroads to pay all damages. Under the old proposition made by the railroad companies, the city would have to pay all land damages.

One of the simplest rules for the guidance of a station agent or telegraph operator who has to execute train orders, is to do precisely what the order says, in each case; no more and no less. It is well known, however, that even so plain a lesson as this often has to be learned through the medium of one or more blunders, and it is, therefore, somewhat surprising that the highest court in the State of New York should decide, as it appears to have virtually done in the eighteenth case reported in the Railroad Law column of this issue, that experience (which may be regarded as the synonym for "blunders") is *not* an important factor in the qualifications of a person for the work we allude to. It is true that a station operator seventeen years old *may* have had considerable experience, but it is a fact that he generally has not had much—at least not much of the kind that trains him to the serious care necessary in his work. Moreover, it goes without saying that important lessons of experience have no visible effect on boys and girls of the age mentioned, except in rare cases. It is, unfortunately, true that many telegraph operators get into responsible positions on railroads without having their ability thoroughly tested, and this may have led to the court's misjudgment regarding the value of a year's so-called experience; but it is not so easy to explain the attitude of mind which accepts, as the court did, the fallacious argument that a young man will be more careful than an older one. The vital difference between expertness in transmitting or receiving messages and a careful habit in reading and executing orders seems to have been overlooked.

If "Uncle Jerry" does not look sharp the business of furnishing rain will be taken out of his hands by people who see money in it. A company has been organized in Kansas by the rival rain maker, Melbourne. Papers have been filed with the Secretary of State by the Artificial Rain Producing Co., with a capital of $100,000. Six of the directors are from Stephens County, Kan., where Melbourne recently made his experiments. The object is stated to be "to furnish water to the public and to produce and increase the fall of rain." Melbourne will make it rain and the company will pay him 10 cents an acre for the land watered by him during the season. We regret that the means by which the company will discriminate between rain produced by Melbourne and rain produced by other agencies are not detailed in the meagre advices that we have received. It is humiliating for a journal of transportation not to be able to say more on a subject so absorbingly interesting and important to everybody who carries wheat and corn, to say nothing of hogs.

Surprise has been expressed that the assistant engineer of the Rapid Transit Commission, New York, should have proposed a plan for the rapid transit railroad in opposition to that of the chief engineer. It has been suggested that this was "unprofessional" and discourteous, and perhaps even "conduct unbecoming an officer and a gentleman." Far be it from us to discourage the amenities and courtesies of the profession, but this is a case in which the sensitiveness seems to have been voluntary and gratuitous. We have been repeatedly told that it was the express wish of the chief engineer that the assistant engineer should prepare and submit an independent plan. He estimated that in this way the subject would get a broader treatment and the public good would be better served; and if the assistant engineer's plan had been accepted the chief engineer would have been the first man to congratulate him.

There is much interest now centred in the Belt Railroad, of Chicago, and there has been a move in railroad circles tending toward a joint control of this road. It is noticeable that there has been a large number of prominent railroad men visiting and inspecting this road recently, and it is believed that the time is not far distant when it will be controlled jointly by the roads entering Chicago. The business which this road does is enormous; recently 12 miles of freight cars were transferred over its 16 miles of track in 24 hours.

NEW PUBLICATIONS.

State of New York.—Annual Report of the State Engineer and Surveyor for the year ending Sept. 30, 1890. By John Bogart. Albany, 1891. 457 pages. 8vo, with maps, plates and index.

Mr. Bogart reports the canal banks as in general in good repair, but he points out the necessity for renewing the trunks of the three large aqueducts on the Mohawk; two over that river and one over the Schoharie Creek. These aqueducts are timber trunks on masonry piers and are in such an advanced state of decay that there is danger of serious interruption to the traffic of the Erie canal.

The total length of the state canal system (the Delaware & Hudson canal is not owned by the State) is 615.93 miles. The Erie canal, from Buffalo to Albany, is 352.18 miles long, with 72 twin locks (*i. e.* side by side); 38 of these have been lengthened so as to chamber two boats and are 221 ft. long. The old locks are 110 ft. × 18 ft. in plan, with 6 ft. of water on the mitre sills. The Erie canal passes boats 98 ft. long 17.5 ft. beam and 6 ft. draft, carrying 240 tons; so does the Oswego, 38 miles long, with 18 locks, 11 of which have been lengthened; and also the Cayuga and Seneca, 23 miles long, with 11 locks, none of which have been lengthened. The Erie has 63 per cent. of the tonnage of the state canals, the Oswego, 4 3 per cent.; the Cayuga & Seneca, 1.2 per cent.

The Champlain canal, from Whitehall on Lake Champlain to Troy, is 65.75 miles long with a 12-mile feeder to Glenns Falls. Its locks are 110 ft. × 18 ft., but the depth of the canal is only 5 ft., as against 7 ft. in the Erie and other canals above mentioned, and the boats navigating it can only carry 155 tons. Its traffic, which for 1890 was 29 per cent. of the total tonnage, is rapidly increasing, and 16 miles have already been deepened to 6 ft.

Lengthening the locks so that two boats can be passed

at once, which was commenced in 1885, has so far progressed that there are four lengths on the Erie canal aggregating 322 miles and varying from 32 to 136 miles over which two boats can pass without breaking the connections; and there are 31 miles of continuous navigation for two boats on the Oswego canal.

The improvement of the depth of the Hudson River has been advanced so that there is now a channel 175 ft. wide and 11 ft. deep from Coxsackie to Albany, and between Albany and Troy the width is 140 ft., with a depth of 10 ft.; while between Troy and the State Dam the width is 80 ft. with a depth of 6 ft. Congress has appropriated $10,000 for a survey for a ship canal to Troy. It is not generally known that the Hudson River is navigable for vessels drawing 30 ft. from New York to above Hudson, or over 120 miles. This leaves about 30 miles to Troy on which improvements for an increased depth would be required. About 18,000,000 tons are transported on the river annually, and there are few watercourses in the world so important.

Possibly the portion of Mr. Bogart's report that will excite the most general interest is the result of a survey of the crest line of Niagara Falls made last year, as compared with a like survey made by the State Geologist, Dr. James Hall, in 1842. The comparison shows that at the American Fall there has been a mean total recession of 30.75 ft. in the 48 years, or at the rate of 0.64 ft. yearly, and the Horseshoe Fall shows a recession of 104.51 ft. in the same time, or at the annual rate of 2.18 ft. The length of the crest line of the American Falls has decreased from 1,080 to 1,060, and the length of crest line of the Horseshoe Fall has increased from 2,260 to 3,010 during this period, while the areas that have been worn away are, for the American Fall 0.755 of an acre, and for the Horseshoe Fall, 6.32 acres. The points used in this survey have been permanently fixed, so that at any future time the rate of recession can be easily ascertained.

Common Sense in Making and Using Steam: Facts for the Consideration of Proprietors of Steam Plants. By One Who Has Paid for His Experience. Boston: The Mason Regulator Co., 1891. Sixty pages, price 25 cents.

On the whole, the advice given in this little book is fairly sound, though it is so commonplace that we doubt if there are many proprietors of steam plants, and certainly there are few engineers in charge of plants, who are not conversant with all the book contains that is correct and worth remembering; so we question if even at the moderate price of 25 cents the purchaser of the book will think he has made a great bargain. It contains many curious notions and some errors. In the preface, the author explains the reasons for his good opinion of himself, and emphasizes the fact that his knowledge of "steam engineering" is derived from his own practical experience. His book certainly gives enough internal evidence that in his mind facts, as taught by science and by other men's experience, do not of themselves figure as items of great importance.

The author considers horizontal tubular boilers of all types as less efficient than water tube boilers, and water-tube boilers, in turn, less efficient than the "porcupine type," which latter type he considers, "like the Corliss engine, to be a step in advance, and to be recognized as such, and to be built by all boilermakers as soon as its various patents expire." The relative efficiency of these three types is placed by him as at about 8, 9 and 10. Most authorities who have looked into the question on the basis of accurate tests, find the efficiency of all well designed types of boilers (not absolutely faulty in circulation) about the same, when heating surface, grate surface, combustion chamber, tube and draught area, etc., are properly proportioned, but probably the author judges solely by his own experience.

Again he defines as the unit of horse-power of boilers as "adopted by the best boiler makers, the evaporation of 30 lbs. of water per hour into dry steam from and at the boiling point, under the atmospheric pressure of the sea level." Inasmuch as the committee appointed by the American Society of Mechanical Engineers has recommended, and all experts now use "the evaporation of 30 lbs. of water per hour from a feed water temperature of 100° Fah., into the steam at 70 lbs. pressure," as the unit of horse-power of boilers, the "best boiler makers alluded to by our author had better come round and adopt the unit by which the rating of these boilers will be judged in case of dispute. We should, however, question the correctness of our author's statement, remembering for instance, that the largest boiler concern in the world, the Babcock & Wilcox Co., adopt the American Society of Mechanical Engineers (the Centennial) standard, as do many others.

There are engineers who do not share the author's view that "there is no way in which exhaust steam can be used so advantageously as in creating a vacuum to increase the power of the engine, provided everything is properly arranged and proportioned." They would contend that when the exhaust steam can be used in whole or in greater part for heating buildings, the proprietor is earning greater dividends, and they would undertake to prove it by the records of science, experiment and experience.

How to Become an Engineer. By Geo. W. Plympton, M. Am. Soc. C. E. New York: D. Van Nostrand Company, 1891. 18mo. Pages, 218. Price, 50 cents.

As an instructor in a prominent technical school, and as the able director of the night school of the Cooper Institute, where hundreds of young men, struggling through apprenticeships in various branches of industrial art, are seeking to increase their efficiency by nightly instruction in theory, Professor Plympton would seem to be peculiarly fitted to prepare such a guide book to the places and means for acquiring technical knowledge, as this little work aims to be. It is very comprehensive. The courses of instruction in prominent American, British and European institutions are given *in extenso*, and the requirements for graduated engineers and the methods in vogue for reaching the respective standards in various countries are compared.

We note a preponderance of the practical over the theoretical training, in fact an evident superficiality in the theoretical training, as characteristic of the English system, and it may be interesting to record that several years ago a distinguished professor of the University of London wrote to a young man in this country that while it might be pleasant on some accounts to pass his academical years in England, it would be at a loss of practical advancement in his scientific education, as the American technical schools were vastly in advance of the English. On the continent there is an excess of training in Germany over what is required for efficiency in any special branch of practical work, and France is conspicuous for a high theoretical proficiency, to which circumstance Prof. Plympton ascribes the growth of *savants* and scientific experimenters for which France is to remarkable.

One of the most interesting features of the book is a collection of extracts from addresses and other utterances of a number of the most eminent practical engineers whom this country has produced, upon the important question of the qualifications for engineering practice and the best courses for the preparation of young men entering the profession. We have here the opinions of self-made men like John B. Jervis, whose first contact with the profession was as an axeman for the engineers who were surveying the route for the Erie Canal, and scholarly engineers like Alexander L. Holley, Ashbel Welch, T. C. Clarke, and Robert H. Thurston. The doctors disagree to some extent, of course, but there is a general unanimity of sentiment in favor of broader culture, and of a more systematic admixture of practical work—not mere school shop work—with the higher theoretical education. It is, as we said, a guide book of value to the student who has arrived at the critical point of deciding upon the final step in his technical training, and not without value to teachers in the scientific preparatory schools.

Irrigation Statistics of the Territory of Utah. By Charles L. Stevenson, Secretary Utah Statistics Committee. Salt Lake City, 1891.

This pamphlet of 36 pages gives statistics of the irrigated and non-irrigated area of Utah, with some account of the results obtained and of the methods of irrigation. Some of the more important matters that are presented in this pamphlet will be found in an article in another column of this issue.

The Railroad Car Journal.—The paper heretofore known as the *Journal of Railroad Car Heating* is now issued under the title of the *Railroad Car Journal.* It is proposed to enlarge its scope considerably, as the title would indicate. It is published monthly at 132 Nassau street, New York City, Mr. E. A. Phillips, Editor and Manager.

Messrs. John Wiley & Sons announce as in preparation a "Manual of Mining," by Prof. M. C. Ihlseng.

The Census Bulletin on Iron Ore.

Mr. John Birkinbine, the President of the Institute of Mining Engineers, reports of the iron ore production in 1889 that it was 14,518,041 gross tons, valued at $33,351,978, an average of $2.30 per ton; as against a total as reported at the preceding census of 7,120,362 gross tons, valued at $23,156,957, an average of $3.25 per ton. The increase was almost 104 per cent. in amount, which was accompanied by a decrease of 29 per cent. in the value per ton. This decrease in the average price has occurred during a decade in which our production of steel has increased from 879,650 to 3,382,654 gross tons, or 285 per cent., while the production of pig iron increased only 153 per cent.; evidently calling for an increasing percentage of high grade ores. It has been concurrent with an increase in the average yearly wages paid per employé from $308.94 to $409.95, or 32.7 per cent., and an increase in the capital invested in the mines from $61,782,287 to $109,766,199, or 77.67 per cent. At the same time small producers have been almost eliminated. The last census reported 1,125 producers furnishing less than 300 tons, and only 81 are returned by this. Mines have, at the same time, fallen under stronger financial management, and their management has been consolidated under a higher priced and less costly staff, which has expended money freely for better machinery. So that, as a general principle, the production per hand is largest in the largest mines.

The percentages given above may be sufficiently interesting to justify their tabulation as below:

	Percentage of Increase.	Decrease.
Production, total	104	
Value, per ton		29
Wages, per hand	33	
Capital, total	78	

The principal producing states with their production are given below:

States.	Production, gross tons.	Percentage.
Michigan	5,856,169	40.34
Alabama	1,570,319	10.82
Pennsylvania	1,560,234	10.75
New York	1,247,537	8.59
Minnesota	864,508	5.95
Wisconsin	837,399	5.77
Virginia and West Virginia	511,255	3.52
Tennessee	473,294	3.26
New Jersey	415,510	2.86

The production of the four largest mines varied between 500,000 and 809,000 tons. Eleven states have decreased their production: New Jersey by 38.55 per cent., and Pennsylvania by 20.05 per cent. Pennsylvania has ranked as the first ore producer until this census. Alabama, which is now second, held the 15th and 16th places in 1860 and 1870, reaching the seventh in 1880.

As the census year for the production of pig iron ended with June 30, 1890, and that for the production of iron ore ended Dec. 31, 1889, there is uncertainty about the average percentage of iron obtained from the ore used. Mr. Birkinbine puts it at 51.27 per cent. The largest percentages are obtained from Spanish and African ores, viz., 63.6 and 60.2 per cent. Lake Superior ores average about 60 per cent.

The capital invested in iron ore mines mentioned above, $109,766,199, does not include investments in ore shipping and receiving docks, railroads, cars or vessels, or houses. These items are in some instances very large, notably for the Vermillion mines, where nearly 100 miles of railroad have been built, besides the harbor, with 2,112 ft. of docks and 303 ore pockets. Iron mining in this country gives direct employment to 37,227 persons.

This report both in its contents and arrangement is more satisfactory than some previous bulletins of the Census Office. It is, however, to be regretted that the scope of the investigations did not include the amount of transportation supplied by the mines to the carriers. On the basis of the production of 1889, our make of pig iron last year must have furnished fully 19.5 million tons of freight, all of which, virtually, had more or less railroad transportation, and some of it had much more than the average haul. The transportation of iron ore was also a very important factor in the prosperity of the lake marine. Altogether the carriage of iron ore and its derivatives must add materially to both the payments for wages and the fund from which dividends are paid, and the subject seems too important to be entirely neglected.

Irrigation in Utah.

As pertinent to the Irrigation Congress lately in session in Salt Lake City, Mr. Charles L. Stevenson, C. E., of that city, as secretary of a committee appointed for the purpose, has compiled a report on the irrigable lands of Utah. The total acreage of irrigable lands is 2,304,000, or 4.23 per cent. of its area, of which 735,226 acres are now covered by ditches, and 333,404 acres were actually irrigated in 1890; in addition to which 89,960 acres, mostly lying on the foot hills of the Wasatch Mountains, were cultivated without irrigation, although the crops would be increased both in certainty and amount by irrigation or addition of water, as the rainfall is precarious.

Utah is divided in this report into three divisions: The moist counties, where the rainfall exceeds 12 in. per annum; the dry counties, where the rainfall is from 12 to 6 in.; and the hot counties "with a slight rainfall and great heat." In Salt Lake Valley, in the moist division, with an average precipitation of 17 in., 40 per cent. of the rainfall occurs in the spring, 9 per cent. in the summer, 25 per cent. in the fall and 26 per cent. in the winter. It is here at an elevation of about 4,200 ft. and with the Wasatch peaks towering 8,000 to 9,000 ft. above them that the largest population is found. This valley is watered by the Bear, Weber and Timpanagos which is called the Jordan after leaving Utah Lake, all of which rise close together in the Uintah Mountains and cut through the Wasatch range, the Bear River flowing as far north as Idaho in its course.

These streams are fed (excepting a slight precipitation in spring and summer from Salt Lake) by the snow fall in the winter, which is often heavy enough to last through the year in high valleys, so that the volume depends on the rate at which the snow melts. In the middle of June this often causes causes considerable damage. The minimum flow is during the coldest weather of winter. Reservoirs in the mountain valleys (all of these streams run through cañons) would obviously increase the water available for irrigation.

In addition to the three large streams above mentioned there are smaller streams, many of which are persistent through the year, flowing out of the smaller cañons and valleys in the mountains, and 2.524 artesians wells have been sunk for the irrigation of gardens, stock watering, and domestic supply. Reports from 879 of these show an average depth of 145¼ ft. with an average discharge of 0.06 cu. ft. per second. These wells are mostly confined to the lower parts of the valleys along the Wasatch Mountains, and to the lacustrine deposits of "Lake Bonneville," as the geologists have named the immense body of water which once covered so large a part of Utah and Nevada.

The first canals in Utah were of course small, and it was not until 1879 that the Jordan Canal for giving additional water to Salt Lake City was commenced. Its length is 27 miles and it is 20 ft. wide on the bottom

with a depth of 5 ft., intended to carry 3½ ft. of water. Now 132 miles of canals originate from Utah Lake and its outlet, the Jordan. The largest enterprise in the territory is the canal built by the Bear River Canal Co.; they take 1,000 cu. ft. per second out of each side of the river and have 200,000 acres tributary to them. In addition to an asserted mean annual flow of Bear River of 5,000 cu. ft. Bear Lake, which discharges into the river and has an area of 150 square miles, can have its waters raised 10 ft. by a dam and the flow of the river can be turned into it making an impounding reservoir. Further south and west are other canal and reservoir companies, while the southwest corner of the territory is irrigable from the Colorado and its tributaries rising in the Uintah Mountains.

In irrigating each farmer has canals leading from the main one to every field and generally along the whole length of the upper side of each field, and from this furrows are drawn parallel to each other and with the proper distance, to the other side of the field, down which the irrigation water passes in succession. In cases where there is sufficient clay in the soil it is found preferable to throw up little embankments 6 in. high around small plats of land; these are filled in rotation. The water is divided by giving each farm all of it for a certain number of hours at stated times, or the water may be permanently divided by a dam with a partition, or when rights are to a certain number of cubic feet, or miner's inches, gates are put in the dams and raised or lowered until the water reaches a mark 6 in. above the bottom. The length and width of the waterway are multiplied together and the product called so many miner's inches. Forty-eight of these are reckoned equivalent to 1 cu. ft. per second. Those having secondary rights get what is left after the primary rights are filled.

The irrigation season generally begins in May or June and ends in August, lasting about 120 days. The amount that 1 cu. ft. per second can irrigate ranges from 35 in the very hot and sultry country of the south to 150 acres in the higher valleys, the average being about 1 cu. ft. to 100 acres. As the ditches have been built, many of them, by following the Indian method of keeping the water upon the work as it proceeds, the ascertained average, first cost of water rights in Utah, is $10.55 per acre. The average duty of the artesian wells mentioned above is 4.74 acres per well, and as the average cost has been $77.60 per well the average cost per successful well has been $16.37 per acre.

TECHNICAL.

Manufacturing and Business.

The Electric Merchandise Co. reports sales of Burton electric heaters to the following roads: Spokane street, railway, Spokane, Wash.; Danville electric railway, Danville, Ill.; Stillwater electric railway, Stillwater, Minn.; Terre Haute Street Railway Co., Terre Haute, Ind.; Burlington electric railway, Burlington, Ia.; Reading & Southwestern railway, Reading, Pa.; Eau Claire street railway, Eau Claire, Wis.; People's street railway, Springfield, Ill.; Salt Lake Rapid Transit Co., Salt Lake City, Utah; Electrical Supply & Construction Co., Pittsburgh, Pa.; Minneapolis Street Railway Co., Minneapolis Minn.; Pullman Palace Car Co., and the Windsor & Sandwich Railway, Windsor, Canada.

The town of Brookville, Ind., is now putting in waterworks. The contract for the pumping engine, boilers, heaters, etc., has been awarded to the Laidlaw & Dunn Co., of Cincinnati, O., which is now doing a large business in water-works pumping engines.

The Consolidated Car Heating Co. has established a department for heating mills, street car houses and large buildings where some of its special appliances can be used to advantage. This department will be under the immediate supervision of Mr. Edwin A. Smith, Assistant Secretary. The commingler, which operates any hot water heating circulation with two pounds or less of steam pressure and through many hundred feet of pipe, is to be a special feature of this new department. Its serviceableness is shown by the fact that the Whitehall tunnel ditches on the Delaware & Hudson Canal Co.'s road are kept free from ice in winter by a commingler circulation through 2,000 ft. of pipe. The Albany Electric Railroad car house has 3,500 ft. of pipe in which hot water is circulated by the commingler. The McElroy steam coupler is already used in mills and manufactories where a simple pipe connection is desired. The sale of this coupler for these purposes will be a feature of the new department. The Consolidated Car Heating Co. will supply material and blue prints to house heating and manufacturing concerns, but will do none of the work of applying.

New Shops and Stations.

The Northern Pacific will erect new stations at once at Puyallup, Wash., on the Cascade division, and at Centralia, Wash., on the Pacific division. The cost of each building will be about $5,000. The plans for the two structures are exactly similar, and they will be 120 ft. in length and 36 ft. in depth. The contractor is P. N. Jepson, of Tacoma, Wash.

The Florida Central & Peninsula Railroad Co. has commenced building large machine shops at Fernandina, Fla. Mr. M. J. Rogers, Master Mechanic, formerly of the Santa Fe, has charge of the construction. Four other buildings will follow the machine shops, which is to be of wood with a tin roof, 70 × 110 ft. The blacksmith shop will be 40 × 80 ft.; the carpenter and paint shop 40 × 70 ft.; and the car shop 40 × 200 ft. The entire plant at Tallahassee will be moved to the new shops as soon as completed. There are now employed in the Tallahassee shops between 150 and 200 men.

The Berlin Iron Bridge Co., of East Berlin, Conn., has received the contract for a new blacksmith shop building for the Dickson Mfg. Co., of Scranton, Pa. Owing to the peculiar formation of the ground the building will be in the form of the letter L, and will be 60 ft. wide by 235 ft. long, constructed entirely of iron.

The St. Clair Tunnel.

The Grand Trunk Tunnel at Port Huron is not yet in regular use, but trains are occasionally run through it. So far the results have been satisfactory. A train is run through in a few minutes, the only delay being caused by changing engines at each side of the river. In running a solid freight train through there is a saving of from three and a half to four hours over the old method of breaking up a train and taking it over in sections by boat.

Electric Car Lighting.

A car of the Great Northern, of England, is supposed to have taken fire from the electric lighting wires with which it was equipped. The accident occurred the last week in August. The cars are lighted by electricity, the current being supplied by a dynamo in the rear guard's van. Flames were discovered issuing from the chamber in which this dynamo stands. The train was stopped and the fire quickly extinguished. It is supposed that the fire was set by defective insulation.

Another Mountain Railroad.

Another new mountain railroad project is now on foot in Switzerland, the scheme being for a line up the Säntis, which is about 2,000 ft. higher than the Rigi, and is said to afford much finer views. The Säntis is visited annually by from 6,000 to 10,000 tourists, and it is believed that the construction of the contemplated road would increase this number tenfold. According to present estimates, however, an annual patronage of only 18,000 passengers would be necessary to enable the line to pay a dividend of 4½ per cent.

Petroleum Manufactures in Peru.

Recent advices from Peru report the completion of large storage tanks at Callao for the finer qualities of lubricating oil, benzine and other manufactures of petroleum now being produced in that country. Large tanks have been erected for storing the refuse of the petroleum which is now being used exclusively as fuel on the coasting steamers, and is coming into use also upon the railroads. Several manufacturing establishments at Lima are now arranging to introduce petroleum as fuel instead of coal. Three years ago Peru imported all of her petroleum from the United States.

Interlocking.

The Johnson Railroad Signal Co. is to put in a 50-lever interlocking machine at the Forty-ninth street tower in the Grand Central Station yard, New York City.

National Legislation on Safety Appliances.

The committee on safety appliances, appointed at the last Annual Convention of Railroad Commissioners, will hold a meeting on Nov. 10, at 10 o'clock a. m., in the rooms of the Chamber of Commerce in the Mutual Life Insurance Building, 34 Nassau street, New York City, to consider the subject of safety appliances, in compliance with the resolutions adopted at that convention, a copy of which is enclosed herewith. It is the wish of the committee that all organizations of railroad employés or officials shall have representatives at this meeting to give their views or recommendations upon the subject of Federal regulation of safety appliances. The committee consists of Messrs. George C. Crocker, Chairman; James C. Hill, Spencer Smith, William E. Rogers, John H. King and Edward A. Moseley, Secretary.

Car Heating and Ventilation.

A new enterprise in car heating is that of the McLeod Car Heating & Ventilating Co., 125 and 127 Worth street, New York City. Hot air is the medium. The system consists of a coil of wrought iron or steel pipe which is placed in the extension front smokebox of the locomotive, with connecting pipes extending to and through each car in the train, down one side and around back on the other side to the coil for reheating. Automatic couplers connect the cars. A current of fresh air, taken up in front of the locomove, is forced through the coil and circulated through the connecting pipes and into each car of the train by a special air pump attached to the locomotive. The coil is placed in the locomotive smokebox, where it cannot interfere with the draft of the locomotive and where it is heated by the waste heat of the locomotive. The pipes in the cars are so placed under the seats as to insure a continuous circulating current of warm air to the rear of the train on one side and to the front on the other side, heating both sides of the car equally well.

The system is to provide pure air of sufficient temperature and volume to keep the last car of the longest train perfectly comfortable and thoroughly ventilated in the coldest weather. Automatic registers and valves, governed by thermostats, are devised to admit the warm air in quantities to each car. These will be also under control of the train men to enable them to increase or decrease the supply of hot air. The cars are thoroughly heated at terminal stations, before being occupied by passengers, by the switching and regular locomotives. To overcome the difficulty of heating cars in cases of accident to the locomotive, or when cars are unavoidably detached before being vacated by passengers, it is proposed that the existing stoves with the necessary fuel shall remain in the cars to be used only in such events.

The same apparatus detached from the heating coil, and connected with cooling reservoirs, will be used to circulate fresh air through the cars in hot weather.

Crude Petroleum Fuel.

A very successful experiment was made recently on the Manitou & Pike's Peak to burn crude petroleum in the locomotives. The apparatus consists of a single jet placed in the centre of the firebox pointing directly to an inverted firebrick arch. The oil is spread, as usual, by a jet of steam or air. The oil used is obtained in Colorado, and has little or no odor. As a result of these tests, it is probable that next year all engines on this road will be equipped with oil burners, and from the present indications there will be a decided saving in the cost of fuel and an absence of all smoke and objectionable gases.

A Good Name Plate Metal.

A good material for engine name plates and the like may be made as follows: To 100 parts by weight of copper thoroughly melted add successively, each being carefully pulverized, 6 parts of magnesia, 57 of sal-ammoniac, 18 of quicklime and 9 of cream of tartar. Stir constantly while adding the above, then add 15 parts of either zinc or tin in small portions, the stirring being continued until the whole is thoroughly melted and mixed. After resting in a molten condition for half an hour, the surface is skimmed and the metal made use of. The resulting metal has a fine grain, is easily polished, is malleable and is slow in tarnishing.

The Jull Snow Plow.

The Jull Snow Plow Co. has delivered at Chicago this week two new plows built by the Rogers Locomotive & Machine Works, of Paterson, N. J. One to the Chicago, Burlington & Quincy for the lines in the Black Hills, and one to the Chicago & Northwestern. Other sales in the west are being consummated.

The Fontaine Time Signal.

The Fontaine Safety Signal Co. last week gave an exhibition of its signal on the Chicago & Alton, running a special train for guests from Chicago to Joliet and return. The signal has been in use here for several months with satisfaction. As our readers know, this is a time signal and indicates to an engineman the length of time elapsed since the last preceding train passed the signal. The first wheel of a passing train, acting on the end of a lever projecting slightly above the top of the rail, throws the index hand on a dial to zero, and at the same time winds a clock located in a small box near the centre of the post. The clockwork and the dial can be arranged to indicate up to any reasonable limit, but with the signals a mile apart 20 minutes is the usual limit. There are six or seven of these signals on each of the two tracks between Chicago and Joliet. The usual plan with this kind of signals is to place them near curves, and when judiciously located, with sufficient frequency, they can be made to afford runners considerable confidence as to the position of the preceding train, which would otherwise be impossible without a block system. With the comparative cheapness of a time signal and the facility with which it may be located at any desired point, it becomes in some respects more valuable than a station indicator, on which the time is bulletined by the station man. The clock will not forget its duty.

THE SCRAP HEAP.

Notes.

The Richmond & Danville, after a conference with a conductors' committee, has readjusted the pay of conductors throughout the system, doing away with various inequalities. It is said that no reduction is made in any case.

Thomas Tobin, the freight conductor whose train occasioned the collision which resulted in the death of 15 passengers at Montezuma, N. Y., Aug. 15, has been indicted for manslaughter in the first degree by the grand jury at Auburn, N. Y.

The convention of the Brotherhood of Railway Trainmen, which has been in session at Galesburg, Ill., for a week or two, has unanimously re-elected Grand Master S. D. Wilkinson, First Vice Grand Master P. H. Morrissey and Grand Secretary W. A. Sheahan. This action is regarded as a complete vindication of the course taken by these officers in the complications resulting from the contest with the yardmen on the Chicago & Northwestern.

The committees of the Brotherhood of Railway Section Foremen and Order of Railway Trackmen have completed the amalgamation of the two orders. The name of the association will be the "International Brotherhood of Railway Track Foremen." St. Louis was selected as the international headquarters of the order, and the next meeting will be held in Cincinnati in October, 1892. John T. Wilson, of Tennessee, was made Grand Chief Foreman; R. P. Bridges, of Kansas, Vice Grand Chief; M. O'Dowd, of Kansas City, Secretary and Treasurer.

World's Fair Notes.

Some of the recent items of news in World's Fair circles in Chicago are as follows: A conference was held between the Transportation Committee and the representatives of the Illinois Central Railroad and the South Side Cable Co. with a view of providing sufficient means of transportation.

It has been found that $75,000 will have to be expended in strengthening the Electricity building, the designs of which are not now considered to be satisfactory.

Arrangements have been made whereby the oil and gas companies of this country, headed by the Standard Oil Co., and supplemented by the oil companies of Russia, will make a large and complete display of all apparatus connected with the development of oil industries, and a complete line of products made therefrom.

The celebrated phosphate collection belonging to the University of Georgia will be loaned to the Mines department.

At a recent consultation of the heads of the various departments with the Chief of Construction, the necessity was urged upon all interested that the present efforts to complete the World's Fair buildings on time be redoubled.

The General Western Agent of the Atlantic Transit line of steamers has notified Traffic Manager Jaycox that all "handy packages" containing exhibits for the World's Fair will be transported free of cost. This line of steamers runs between London, Philadelphia, New York and Baltimore, and is the first Atlantic steamship line to offer to carry exhibits free.

The contract for the construction of the Government World's Fair buildings have been awarded. Some of the contracts show the approximate cost of the buildings will be $316,767. Four hundred thousand dollars was set apart by the Government for this purpose, and there remains about $84,000 to be used for future extensions.

It is expected that in 60 days all the woodwork of the Woman's building will be finished. It will be the first World's Fair building completed.

The Chief of Construction has been authorized to contract with the Crane Elevator Co. for eight electric elevators in the Administration building.

The New York Stock Exchange.

The Governing Committee of the New York Stock Exchange has listed for dealings on the Exchange $14,350,400 of securities, as follows:—

Brooklyn Elevated.—(Union Elevated Railroad)—$500,000 additional first mortgage six per cent. guaranteed bonds, making the total amount listed $6,000,000.

Cleveland, Cincinnati, Chicago & St. Louis.—$712,400 additional common capital stock, making the total amount listed $28,000,000.

Illinois Central.—$600,000 additional four per cent. gold bonds, making the total amount listed $14,331,000.

Montana Central.—$500,000 first mortgage five per cent. convertible bonds.

Mexican Central.—$2,596,000 additional consolidated mortgage four per cent. bonds, making the total amount listed $55,840,000; $766,000 additional first consolidated income bonds, making the total amount listed $16,739,000, and $1,077,000 additional second consolidated income bonds, making the total amount listed $11,724,000.

Northern Pacific.—$4,399,000 additional railroad and land grant consolidated mortgage five per cent. gold convertible bonds, making the total amount listed $43,329,000.

Union Pacific.—$2,500,000 six per cent. gold collateral coupon notes of 1894. The Committee on Stock List is empowered to add to the lists as issued these notes up to $20,000,000.

A Field for Metal Ties.

The washout on the Five Mile Beach branch of the West Jersey Railroad, between Burleigh and Anglesea, will prevent the running of trains for several days. The employés of the company state that for a distance of three-quarters of a mile, between Grassy Sounds drawbridge and the main land, the track was entirely off the roadbed, and was only kept from floating away by the line of telegraph poles on the south side.

Iron Ore Dock.

An additional ore dock will be built by the Duluth & Iron Range at Two Harbors, Minn., during the winter. It will be 500 ft. long, 50 ft. high, and will contain 84 pockets with a capacity of 120 tons each, making the dock capable of storing 10,000 tons of ore. Tenders have been received for dredging and grading, and within a month the rest of the contracts will also be let.

Law vs. Justice.

M. J. Butler, a clerk in the Chicago, Milwaukee & St. Paul freight department, was given a vacation and non-transferable passes for himself and wife from Chicago to Minneapolis and return. Butler sold or gave away the passes, which were used by other parties. The company docked Butler's salary $46 the value of the passes, and he brought suit to recover the money, securing a verdict for that amount.—*Chicago paper.*

The Kodak for Car Inspectors.

Master Mechanic Turner, of the Western New York & Pennsylvania at Olean, has in use a kodak for the purpose of taking photographs with which he can present indisputable evidence of the appearance of cars that his inspectors find defective or improperly loaded.

Minnesota Commission Law.

Application was made to the Railroad Commissioners of the State of Minnesota for an order compelling the Great Northern to construct a side track at the point where the county road intersects the railroad between Shell River and Park Rapids. The railroad company refused, saying they were constructing one at Shell River. Then the matter was brought before the Commissioners, who have decided not to issue such an order, since the stations are only six miles apart, and the law only allows them to order side tracks where the stations are 10 miles or more apart.

Admission Fees on the Installment Plan.—Begin Now.

A corporation has been formed at Chicago to be known as the "World's Fair Trust Fund Transportation Co.," to furnish railroad transportation to and from the Fair, board, lodging and admissions to the Fair for six days, transfer of baggage, etc. For this service a stated sum is fixed by the company in each case and a certificate is issued which can be paid up or paid in monthly installments. The prospectus of the company contains the names of well known citizens of Chicago and states that 5,000 rooms and board have been secured for the entire period.

LOCOMOTIVE BUILDING.

The Lake Erie & Western has ordered 12 moguls from the Brooks Locomotive Works.

The Rhode Island Locomotive Works are building six locomotives for the Chicago, Milwaukee & St. Paul road, some of them 10 wheelers.

The recent order of the Pennsylvania for compound locomotives placed with the Baldwin Locomotive Works is for five engines, with the Vauclain cylinders.

The recent order of the New York Central & Hudson River road placed with the Schenectady Locomotive Works was for 20 eight wheelers for fast passenger service, and 11 other passenger engines, and for 19 moguls.

The Baldwin Locomotive Works have completed a compound condensing steam motor for street railroads. It is built with the Vauclain cylinders and has an air condenser. A recent trial proved beyond doubt the success of the machine, and the condenser worked as well as could be desired.

The New York, Lake Erie & Western has ordered five compound decapods from the Baldwin Locomotive Works. The total weight of each will be 177,000 lbs. The cylinders will be of the Vauclain compound type, 16 in. and 27 in. by 28 in. stroke.

The Manitou & Pike's Peak Railroad has ordered from the Baldwin Locomotive Works a new locomotive with the Abt system of track gear for use next season. The locomotive will have the Vauclain compound cylinders and several modifications to remove difficulties which have been found in the operation of such large engines at slow speed. These difficulties pertain generally to the steadiness of the train.

CAR BUILDING.

The Philadelphia Northeastern Elevated road is receiving bids for building about 160 cars for its elevated road.

The Michigan Central is now building in the shops at St. Thomas, Ont., 20 60,000-lb. freight cars equipped with air brakes. As fast as the old 24,000-lb. cars are worn out they are replaced with the 60,000-lb. cars, and the air brake is applied on every car that is more than 30 ft. long that goes out of the shops.

The car works of Messrs. James Harris & Co., at St. John, have been turning out substantially built box cars for the Canadian Pacific, for the last month, at the rate of about 25 cars a week. Last week the contract, which was for 150 cars, was completed.

The St. Charles Car Co. has recently closed contracts for about 600 freight cars. The orders include 50 provision box cars for the Armour Packing Co., 300 coal cars of 60,000 lbs. capacity for the Texas & Pacific, 100 box cars for the Cairo Short Line, and 100 cars, including box, platform and coal cars, for the Paducah, Tennessee & Alabama road.

BRIDGE BUILDING.

Arnprior, Ont.—The Canadian Pacific bridge over the Madawaska River at Arnprior, now being built of stone and iron, by J. W. Munro, will cost $10,000. It is the third bridge built at that point by the railroad.

Austin, Tex.—The Red River Bridge Co., of Austin, has applied for an amendment to its charter, increasing the capital stock of the company from $40,000 to $60,000.

Belmount, Ont.—The County Council of Peterborough, Ont., has decided to add an iron span to Browne's bridge in Belmount.

Bowmanville, Ont.—The contract for the construction of the Weddel bridge over Barber's creek at Bowmanville, Ont., was signed last week. The contract price is $10,540, of which amount the united counties pay one-half. It is stipulated that the bridge shall be finished by Dec. 1.

Burnham, Tex.—A contract has been awarded Joseph Matthis, of Houston, Tex., at $10,000, for the construction of a bridge at Burnham, Tex.

Chappels, S. C.—A contract has been awarded to J. L. Aull, of Dyson, for the construction of a bridge over the Saluda River.

Dahlonega, Ga.—F. M. Williams will receive bids for the construction of a bridge over the Chestatee River in Lumpkin County, until Nov. 7.

Fairmont, W. Va.—The Fairmont Development Co. has awarded the contract for a new bridge over Coal Run, on its property, to the Wrought Iron Bridge Co., of Canton, Ohio. The structure will be 422-ft. in length, having a 36 ft. roadway and 6-ft. walks on each side. The price is $12,750.

Granite, Idaho.—A single track iron trestle viaduct will be built at Granite, Idaho, on the Idaho division of the Northern Pacific.

Middleton, Ont.—Tenders are invited for the construction of a bridge over the Big Otter River in the township of Middleton, Ont.

Minneapolis, Minn.—C. F. Loweth, C. E., of St. Paul, has completed the plans for a highway bridge across the Minneapolis & St. Louis and the Great Northern tracks, at Second street in Minneapolis. The foundation is of Mankato stone and has been finished by the contractors, Widell & Thompson, of Minneapolis. The superstructure will carry a roadway 36 ft. wide and two sidewalks each 6 ft. in width, and will be in one span 130 ft. in length. This contract will be let soon.

Nova Scotia.—Mr. Browne, contractor of Digby, Nova Scotia, has lately been awarded the contract for erecting Lingan bridge and the Glace Bay bridge, both in that province.

Wheeling, W. Va.—The Baltimore & Ohio railroad is building a new bridge for six tracks across Caldwell's Run in the southern part of Wheeling, W. Va. The bridge has been made necessary by a change in the course of Caldwell's Run.

The false work for the new 158 ft. single span arch stone bridge over Wheeling Creek at Wheeling, has been completed and the stone work of the arch will be put in place at once. The bridge is being built by Paige, Carey & Co.

Whitmires, S. C.—A contract has been awarded to J. L. Aull, of Dyson, for the construction of a bridge 332 ft. long, across the Enoree River near that place.

Yorkville, S. C.—J. S. Price, of Yorkville, S. C., invites bids for repairing or rebuilding bridge across Bullock's Creek, near that place.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Maine, semi-annual, 4½ per cent., payable in November.

Concord & Montreal, 3 per cent. on the "B., C., & M. preferred" and "Concord" stock, payable on demand.

Pullman's Palace Car Company, quarterly, $2 per share, payable Nov. 16.

Wheeling & Lake Erie, quarterly, 1¼ per cent. on the preferred stock, payable, Nov. 16.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atchison, Topeka & Santa Fe, annual, Topeka, Kan., Oct. 29.

Baltimore & Ohio, annual, Baltimore, Md., Nov. 16.

Boston, Revere Beach & Lynn, annual, Boston, Mass., Nov. 19.

Boston, Winthrop & Shore, annual, Boston, Mass., Nov. 19.

Brandon & Southwestern, annual, adjourned, Winnipeg, Man., Oct. 26.

Buffalo, Rochester & Pittsburgh, annual, 36 Wall street, New York City, Nov. 16.

Central Massachusetts, annual, Room 15, Boston & Lowell Passenger Station, Boston, Mass., Oct. 28.

Cleveland, Cincinnati, Chicago & St. Louis, annual, Cincinnati, O., Oct. 28

Cleveland & Pittsburgh, special, Cleveland, O., Nov. 18, to vote upon a proposed issue of bonds.

East Tennessee, Virginia & Georgia, annual, Knoxville, Tenn., Nov. 18.

Florence, El Dorado & Walnut Valley, annual, Topeka, Kan., Oct. 29.

Kansas City, Emporia & Southern, annual, Topeka, Kan., Oct. 29.

Kansas City & Memphis Railroad & Bridge Co., annual, West Memphis, Ark., Nov. 4.

Manhattan (Elevated), annual, 71 Broadway, New York City, Nov. 11.

Memphis & Charleston, annual, Memphis, Tenn., and Huntsville, Ala., Nov. 30.

New Orleans & Northeastern, annual, New Orleans, La., Nov. 4.

New York & Northern, annual, 32 Nassau street, New York City, Nov. 11.

New York, Lake Erie & Western, annual, 21 Cortlandt street, New York City, Nov. 24.

St. Louis & San Francisco, annual, Broadway and Pine street, St. Louis, Mo., Oct. 27.

Utah Midland, annual, Walker House, Salt Lake City, Utah, Nov. 2.

Wichita & Southwestern, annual, Topeka, Kan., Oct. 29.

Wichita & Western, annual, Topeka, Kan., Oct. 29.

Wisconsin Central Company, annual, Milwaukee, Wis., Nov. 4.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* meets at its rooms in the United States Hotel, Beach street, Boston, on the second Wednesday of each month, except June, July and August.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings at its rooms in the Gilsey House, New York City, at 2 p. m., on the third Thursday in each month.

The *Southern Railway Club* holds regular meetings on the third Thursday of the months of January, February, March, May, September and November at such points as are selected at each meeting.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month, excepting in January, when the annual meeting is held on the second Saturday of the month. The second January meeting is held on the third Saturday. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month, at 7:30 p. m.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 p. m. on the first Friday of each month.

American Society of Civil Engineers.

The nominating committee appointed at the last annual convention having presented to the Board of Direction nominations for officers for the ensuing year, the Board has ordered the following nominations to be sent out:

President: Mendes Cohen, Baltimore, Md.

Vice-Presidents for two years: Charles B. Brush, New York City; Samuel Winnery, Cincinnati, O.

Vice-Presidents for one year: Samuel F. Gray, Providence, R. I.; John MacLeod, Louisville, Ky.

Directors for three years: Leffert L. Buck, New York City; William P. Craighill, Baltimore, Md.; Desmond Fitzgerald, Brookline, Mass.; Abraham Gottlieb, Chicago, Ill.; Benjamin M. Harrod, New Orleans, La.; John Thomson, New York City.

Directors for two years: Theodore N. Ely, Altoona, Pa.; O. F. Nichols, Brooklyn, N. Y.; George W. McNulty, New York City; Robert Moore, St. Louis, Mo.; P. Alex. Peterson, Montreal, Canada; Robert L. Read, Cincinnati, O.

Directors for one year: Charles H. Myers, New York City; Estavan A. Fuertes, Ithaca, N. Y.; Albert B. Hill, New Haven, Conn.; Edmund T. D. Myers, Richmond, Va.; James D. Schuyler, San Diego, Cal; John G. Van-Horne, New York City.

Secretary: Francis Collingwood, New York City.

Treasurer: John Bogart, New York City.

At its meeting on Oct. 8, the Board of Direction ordered that "in future meetings of the Society, on the third Wednesday of the month, the meeting will be called to order promptly at 20 o'clock, and reading and discussions of papers will continue to 21 o'clock, when a collation will be served and opportunity given for social

intercourse." The following papers were announced as to be read and discussed at the meeting of Oct. 21:

On the Hydraulics of the Hemlock Lake Conduit of the Rochester, N. Y., Water Works, by George W. Rafter, M. Am. Soc. C. E. *On the Measures for Restricting the Use and Waste of Water, in force in the City of Rochester, N. Y.*, by George W. Rafter, M. Am. Soc. C. E.

On the evening of Nov. 4, a paper on *Stone Quarrying*, by Wm. L. Saunders, M. Am. Soc. C. E., will be read, and discussion on the papers by Mr. Rafter continued, if desired. On the evening of Nov. 22, a paper on *The Experimental Determination of the Rolling Friction in Operating the Draw of the Thames River Bridge, etc.*, by A. P. Boller, Jr., and H. J. Schumacher.

New England Railroad Club.

A regular meeting was held Wednesday evening, Oct. 14, 1891. Vice-President Chamberlain occupied the chair. In the absence of Mr. F. M. Curtis, Secretary of the Club, Mr. Charles M. Lang was appointed Secretary *pro tem.*

An invitation to the club to attend the exhibit of the railroad conductors in the fair now being held at New Haven was read, and, on motion of Mr. Adams, it was voted that the thanks of the club be returned to the conductors for their kind invitation.

Mr. J. N. Lauder proposed a change in the by-laws of the club, to be acted on at the next meeting, viz., That Art. I, Sec. I., be changed to read as follows: "The regular meeting of this Club shall be held on the second Wednesday of each alternate month, commencing January, 1892; provided, however, that the meeting in July in each year may be omitted by vote of the club."

The Chairman announced as the subject for discussion at the November meeting, "The Care of Steam-heated Cars at Terminal Points," and the subject for the present occasion, "The Lighting of Passenger Cars," to be opened by Mr. F. D. Adams.

The discussion will be found on another page of this issue.

Northwestern Track & Bridge Association.

A regular meeting of the Northwestern Track & Bridge Association was held in the directors' room of the St. Paul Union depot on Friday, Oct. 16. The members present were: John McMillan, John Copeland, C. B. Brunson, H. A. Buell, W. A. McGonigle, T. J. Mullen, B. T. McIver, C. H. Bauman, John Merry, George W. Downing, A. Cox and the Secretary, Mr. T. B. Graham, S. B. & B., N. P. R. R., was accepted as an active member, and Mr. George Fuller was elected an associate member.

The committee having in charge the arrangements for the convention of the Roadmasters' Association rendered its reports. Resolutions were passed ratifying the committee's action in every respect, and thanking the various corporations, firms, the press and individuals for courtesies extended in connection with the convention.

Mr. McGonagle's paper on "Preservation of Bridge Timbers" was accepted after a brief discussion.

The secretary read a paper by Mr. Rafferty on "Proper Foundation for a Right Angle Crossing." This paper advocated the use of hewn white oak ties 7 in. thick, from 8 to 10 in. face and long enough to be placed diagonally across both tracks. The ties to be used are: two 23 ft. long, two 19 ft. long, two 17 ft. long, two 14 ft. long, one 12 ft. long.

In the discussion which followed the unanimous opinion was in favor of the use of the long ties. It was shown that it is easier and cheaper to build a foundation of ties than of timber; also that it costs less to maintain one of ties. The only disadvantage was in the necessity of angling so many ties before they can be brought to cross the track at right angles again. The further discussion was continued to the December meeting to allow Mr. Rafferty to explain his method of handling the ties beyond the long ones.

The subjects for discussion at the next meeting were selected, viz.: "Best Method of Supporting and Connecting Timbers at a Grade Crossing of a Pile Bridge," to be introduced by Mr. B. T. McIver, and "Standard Frogs," to be opened by Mr. H. A. Buell.

The time for holding meetings was changed from monthly to quarterly.

The members adjourned to the Windsor Hotel for supper, after which the evening was spent in social intercourse and informal discussions.

Northwest Railroad Club.

At the meeting of the Northwest Railroad Club at St. Paul on Tuesday, Oct. 20, the subjects for discussion were: (1) Painting Rolling Stock, by J. O. Pattee, and (2) Fuel and Economy in its Use, by P. H. Conradson.

The American Society of Mechanical Engineers.

The following details of the annual meeting in New York City have been published. The Convention programmes will be ready for distribution at the meeting. *Monday, Nov. 16, at 8:30 p. m.*—Opening session with president's address; followed by a social reunion with collation at the Society's house, No. 12 West 31st street. *Tuesday.*—Morning session at 10 a. m. for society business, at the Society's house. Action on amendments to the rules, reports of committees, and professional papers if time for them. Afternoon, excursions to various points of interest as selected by members. Evening, at 8 o'clock, session for papers. *Wednesday.*—Excursion by boat to see the new work at the Brooklyn Navy Yard, and the shops of the De La Vergne Refrigerating Co. In the evening a theatre party will be tendered by the New York members to the visitors and ladies. Tickets for the American Institute Fair will be provided. *Thursday.*—Session at 10 a. m. for professional papers and discussion. Afternoon, excursions in groups. Evening, 9 p. m., public reception at the Lenox Lyceum, with music and dancing and collation. *Friday.*—Concluding session for papers.

It has been thought advisable to inaugurate some changes in the method of conducting the annual meeting when it is held in New York City, which the above programme outlines. It is the intention that the afternoons of Tuesday and Thursday shall be made available to the visitors for purposes of their own in connection with their visit to the city. For those who may not desire to utilize these afternoons in that way, excursions will be made to different points of interest, led by committees of the local residents, the list of such excursion parties to be announced at the meeting. Special railroad rates on the certificate plan have been secured for the members and their ladies in attendance at the convention, so that the round trip will be made for one and one-third fare. Advance copies of papers to be read at the meeting will be sent only to those who make request for them. No special rates can be obtained in New York at hotels. The list of papers to be presented is as follows, and there is a long series of topical queries: President's Address, R. W. Hunt; Experiments to determine the rate of Rise or Fall of a Mercurial Thermometer under diffferent conditions, Test of Indiana Block Coal at the Chicago West Side Pumping Station and Limitations of Steam Engine Economy, A. F. Nagle; The Value of Water Power, C. T. Main: The Brooklyn Pumping Engine of 1860, S. McElroy; The Idiosyncrasies of Chimney Draught, W. E. Crane; Electric Power Distribution, H. C. Spaulding; Influence of the Steam Jackets of the Pawtucket Pumping Engine, W. Kent; A Combination Iron and Oak Pavement, J. W. Cole; Test of a Pulsometer, De Volson Wood.

Western Railway Club.

A meeting of the Western Railway Club was held this week in the Rookery Building, Chicago, when a paper was presented by Mr. J. N. Barr, Superintendent of Motive Power of the Chicago, Milwaukee & St. Paul, on "Water Purification." Mr. Rhodes' paper on "Air Brake Practice" was discussed at great length. In due time the reports of this meeting will be published in these columns. The amount of equipment represented by the members of this club is one-third of the total equipment of the United States, and extends from the Atlantic to the Pacific coast, and from New Orleans to British Columbia. There are representatives of railroads operating in total 11,000 locomotives and 367,000 cars.

Mr. Waldo Marshall of the *Railway Review* has been elected Secretary of the Western Railway Club in place of Mr. W. D. Crosman, resigned. Mr. Marshall has been Secretary of the Southern and Southwestern Railroad Club since its organization and has just resigned that position.

PERSONAL.

—Gen. George S. Field of the Union Bridge Co., is the candidate of the Democratic party for Commissioner of Public Works of Buffalo, N. Y.

—Mr. C. H. Rockwell, General Superintendent of the Columbus, Hocking Valley & Toledo, has resigned to accept a similar position on the Chicago & Eastern Illinois and Chicago & Indiana coal roads.

—A report from Clarksburg, W. Va., is that the directors of the Pennsboro & Harrisville Railroad Co. have chosen Mrs. H. M. Kimball, widow of the late President and owner, Moses B. Kimball, to be President of the company. She will take charge on Jan. 1.

—Mr. D. B. Robinson, who was appointed General Manager of the San Antonio & Aransas Pass only 10 days ago, has resigned. A week of his time was spent in an examination of the road and its branches. He was formerly General Manager of the Atlantic & Pacific. Mr. George L. Sands, formerly General Superintendent of the Western Division of the Atchison, Topeka & Santa Fe system, is said to be Mr. Robinson's successor.

—Mr. John Baird died at an advanced age in New York City this week. He was Manager of the Metropolitan Elevated road in New York City before its consolidation. He was Chief Engineer of the Cromwell Steamship Line and designed many of its ships. He was for some time connected with the Delamater Iron Works in New York, and was also Manager of the Burden Iron Works at Troy, N. Y.

—Mr. H. W. Hammond, who was appointed Superintendent of the Eastern Division of the Rome, Watertown & Ogdensburg in June, has resigned. He has been connected with the Utica & Black River and Rome, Watertown & Ogdensburg roads for the last 19 years, seven as conductor and 12 years as Assistant Superintendent. It is understood that Mr. Hammond will be transferred to another position with the company.

—Mr. Clem. Hackney, formerly Superintendent of Motive Power of the Union Pacific, has accepted a position with the Fox Solid Pressed Steel Co. as General Manager of the works in the place of Mr. F. P. Davidson, resigned. The many friends of Mr. Hackney, who are well acquainted with his large experience in railroad matters, will be pleased to learn that he has taken hold of this important industry, which is devoted almost exclusively to the manufacture of pressed steel passenger and freight trucks for steam railroads and pressed steel trucks for street railroads. A large business has already been established, and some considerable extensions will be made to meet the increasing demands for the new trucks.

ELECTIONS AND APPOINTMENTS.

Chesapeake & Ohio.—The annual meeting was held in Richmond, Va., Oct. 20. The following board of directors was elected: William P. Anderson, M. E. Ingalls, Cincinnati; D. Axtell, Henry T. Wickham, Richmond; George T. Bliss, C. H. Coster, Charles D. Dickey, Jr., C. P. Huntington, Samuel Spencer, New York. The board last year had 11 members, but A. J. Thomas and E. Norton were not re-elected.

Cincinnati, New Orleans & Texas Pacific.—At the annual meeting in Cincinnati, Oct. 16, the old board was re-elected, with the exception of M. E. Ingalls, who declined, and John H. Inman, President of the Richmond & West Point Terminal, was elected in his place. The Board consists of W. P. Anderson, Calvin S. Brice, S. M. Felton, Alexander McDonald, C. C. Harvey, Samuel Thomas, T. T. Gaff, W. A. Goodman and J. H. Inman.

Columbus, Shawnee & Hocking.—The following officers and Directors were elected at the recent annual meeting: P. W. Huntington, Columbus, President; F. J. Picard, Columbus, Vice-President and General Manager; W. E. Guerin, Secretary and General Solicitor; H. D. Turney, Columbus, Treasurer; Charles Andrews, Zanesville; D. B. Hatch and H. W. Putnam, New York; D. S. Gray, Charles Parratt, G. C. Hoover and Samuel Houston, Columbus.

Dansville & Mount Morris.—The directors of the reorganized company are: Lucius N. Bangs, Buffalo; Ambrose S. Murray, New York; August Stein, E. P. C. Lewis Edwin A. Stevens, Hoboken, N. J.; George Freifeld, Brooklyn; C. E. Tolhurst, Rutherford, N. J.; F. M. Perine and Charles Shepard, Dansville, N. Y.

Denver & Rio Grande.—At the annual meeting of stockholders at Denver, Col., Oct. 20, the following were elected Directors: George Coppell, R. T. Wilson, Adolph Engler, W. Mertens and C. C. Reaman, of New York; J. Lowber Welch and Edmond Smith, of Philadelphia, and Edward T. Jeffrey and Edward O. Wolcott, of Denver. The stock represented was 533,856 shares out of a total issue of 616,500 shares. The officers will be elected in New York Nov. 5.

Fitchburg.—W. D. Erving, formerly General Manager of the Evansville & Terre Haute road, has been appointed Assistant Superintendent of the Fitchburg with headquarters in Boston.

Franklin & Tilton.—The annual meeting of the road at Concord, N. H., Oct. 13, resulted in the election of the following directors: Chas. E. Tilton, Tilton, N. H.; A. W. Sulloway, Franklin, N. H.; C. A. Busiel, Laconia; S. S. Kimball and G. A. Todd, Concord; and Frank Jones, Portsmouth. C. E. Tilton was elected President; E. B. S. Sanborn, Franklin, Clerk; and E. H. Woodman, Concord, Treasurer.

Iowa Central.—The following appointments are announced: H. A. Hausgen, Assistant General Freight Agent, vice James Mahoney, resigned to accept service with another company; and Thomas P. Barry, Assistant General Passenger Agent, to be General Passenger Agent.

Lake Shore & Michigan Southern.—Samuel Rockwell has been appointed Engineer of the Michigan Southern Division, with headquarters at Toledo, O., vice O. D. Richards, resigned; A. H. Smith, Superintendent of the Kalamazoo Division, has been given jurisdiction over the Lansing Division, vice R. C. Harris, resigned. Mr. Smith will be succeeded by A. B. Newell. He is the son of President John Newell, and was a few months ago, appointed Assistant Train Master on the Franklin Division.

Mason City & Fort Dodge.—James Mahoney, formerly Assistant General Freight Agent of the Iowa Central, has been appointed General Freight and Passenger Agent of this road.

Mexican Central.—J. A. Hendry has been appointed Traveling Auditor of this company.

Minneapolis, St. Paul & Sault Ste. Marie.—George W. Hibbard, recently Commercial Agent of the Mexican National at Laredo, Tex., has been appointed Northern Passenger Agent of this road, with headquarters at Marquette, Mich.

Newport News & Mississippi Valley Co.—William Hassman, Master Mechanic of the Chesapeake & Ohio, has been appointed Superintendent of Motive Power of the Western Division of this company, with office at Louisville.

New York, New Haven & Hartford.—At the annual meeting of the stockholders of the company at New Haven, Oct. 21, the directors chosen were: E. H. Throwbridge, New Haven, Conn.; William D. Bishop and Nathaniel Wheeler, of Bridgeport; Henry C. Robinson, L. Brainerd, Hartford; Edward M. Reed, of New Haven; Joseph Park, Chauncy M. Depew, William Rockefeller, J. Pierpont Morgan and W. G. Hunt, of New York; Henry S. Lee, Springfield, Mass.

New York, Pennsylvania & Ohio.—The following Board of Directors was elected at the annual meeting of the company: Charles E. Whitehead, John Tod, E. R. Perkins, W. J. McKinnie, Fayette Brown, J. M. Ferris, H. B. Perkins, Lewis Miller, E. A. Wheeler, Simon Perkins, E. J. Barney, Samuel L. Mather and J. T. Wann, who was chosen to fill a vacancy. The former officers were re-elected as follows: President, Charles E. Whitehead; Vice-President, John Tod; Treasurer, E. R. Perkins; Secretary, E. Tupper; and Auditor, J. T. Wann.

Norfolk, Albermarle & Atlantic.—At a recent meeting of the Board of Directors, George S. Jones was elected President of the company, succeeding Charles W. Mackey, resigned. The office and address of the President will be Mills Building, 35 Wall street, New York.

Pullman's Palace Car Co.—The annual meeting of the company was held in Chicago, Oct. 15. The directors were re-elected as follows: George M. Pullman, Marshall Field, J. W. Doane, Norman Williams, O. S. A. Sprague, Chicago; Henry C. Hulbert, New York, and Henry R. Reed, Boston.

Rhode Island & Massachusetts.—At the annual meeting of the Massachusetts division in Franklin, Mass., Oct. 12, the following officers were elected: President, James P. Ray; Vice-President, Edgar K. Ray; Treasurer, Joseph G. Ray; Clerk, George W. Wiggins; directors, J. P. Ray, J. G. Ray, E. K. Ray, J. F. Ray, G. W. Wiggins, M. A. Wyckoff.

South Brooklyn Railroad & Terminal Co.—At the annual meeting of the company the following Board of Directors was elected: John W. Ambrose, W. Bayard Cutting, Joseph Richardson, Edward T. Hunt, F. K. Hain, Clarence Stephens, and J. A. Murray. The board elected John W. Ambrose president, Joseph Richardson vice president, W. Bayard Cutting treasurer, and Francis H. Bergen secretary.

Tacoma, Edison & Puyallup.—W. H. Smith has been appointed Superintendent of the Tacoma & Puyallup and the Wapato Park Belt Lines, with headquarters at Tacoma, Wash.

Western Maryland.—The annual meeting of the stockholders was held this week and the following directors were elected: Robert Biggs, C. W. Humrichouse, John W. Cable, Edward Worthington and John M. Littig.

RAILROAD CONSTRUCTION.
Incorporations Surveys, etc.

Baltimore & Lehigh.—The article in these columns last week concerning the standard gauging of the line gave an impression of the progress of the work not warranted by the facts. The active work of construction has not yet been decided upon and nothing very definite has been done in that way. The negotiations to secure the funds for carrying out the work are in progress and may soon be completed.

Bath, Small Point & Popham Beach.—The survey of the route for this road will be completed next week. The survey begins at the Maine Central station in Bath, passes down Water street, past the shipyards, thence across Winnegance Bay to Phippsburg.

Bayfield Harbor & Great Western.—The survey for this line is about completed from Bayfield, Wis., to its junction with the Northern Pacific. The grades have been found to be much lighter than was anticipated. The completion of this line places Bayfield, Wis., in the position to utilize the advantages of a good harbor in connection with the lake and rail traffic. W. F. Dalrymple is President, and Isaac H. Wing, Capt. R. D. Pike, all of Bayfield, Wis., are Directors.

Boston & Maine.—A survey has been made this month between Canaan and Orford, N. H., a distance of about 20 miles, for a new line to connect the Passumpsic with the Northern division. The engineers are making surveys on two routes northwest of Canaan, one through Factory Village and the other further west.

Branchville & Bowman.—The company is operating about 9½ miles of road northeast of Branchville, S. C. This portion of the road was received by the State Railroad Commissioners, June 25, and trains have been running since that date. The statement in these columns on Oct. 2 that only half a mile of the road had been graded was erroneous. The length of the line from Branchville to Bowman will be 11 or 12 miles, and the portion of the road not in operation is now under construction. The charter authorizes the extension of the road to any point in Orangeburg County, but locating surveys have not been made beyond Bowman, and the terminus of the line is not yet decided. The capital stock is $24,000, which has been subscribed.

Brandon & Southwestern.—The Dominion Government has refused to sanction the route for this road from Brandon, Man., to the United States line, and consequently the grading has been temporarily suspended until the promoters secure the government's approval of the new route, when the work will be proceeded with.

Brookline & Pepperell.—F. W. Meade & Co., of 53 State street, Boston, Mass., who have the contract for building this road from West Groton, Mass., on the Peterboro branch of the Fitchburg Railroad, northeasterly, through Pepperell, Mass., to Brookline, N. H., 15 miles, have commenced the grading. The work will be light and there will be only one iron bridge. A. W. and F. B. Locke, 53 State street, Boston, are the Engineers.

Burlington & Missouri River.—The line built last year to the Black Hills in South Dakota will probably be early extended by the construction of a number of short branches. Among those likely to be built soon is a line from a point on the Deadwood line near Englewood to Bald Mountain. The contractors will be Kilpatrick Bros. & Collins, of Beatrice, Neb. The Wyoming line has been extended further toward Buffalo and Northwestern Wyoming since July and the end of the track is at a town named Gillette, about 48 miles from Merino, Wyo., and 18 miles beyond Belle Fourche, which had been reached July 1.

Calgary & Edmonton.—This road will not be graded as far as Fort McLeod this season. Work has been stopped at Willow Creek, and the location southward beyond that point has not been definitely decided upon.

Canadian Pacific.—President Van Horne is reported as stating that the directors hope to be able to float securities for the cost of constructing the line from Woodstock, Ont., to the Niagara River at an early date.

Charleston, Clendennin & Sutton.—The permanent survey has been completed for a distance of about six miles from Charleston, W. Va., and the work is still progressing as rapidly as pssible. The route for 20 miles to the Clay County line will be completed this fall, and it is expected that in November a portion of the road at least will be let to contract.

Chicago & Northwestern.—John S. Barrow, Assistant General Passenger and Ticket Agent, has resigned and the duties formerly performed by Mr. Barrow will be consolidated with those under W. B. Kniskerm, Assistant General Passenger and Ticket Agent.

Columbus, Shawnee & Hocking.—At the annual meeting last week the stockholders voted to authorize the directors to arrange for a lease of the Sandusky, Columbus, Lake Erie & Southern, a road projected between Columbus and Sandusky, O.

Concord & Montreal.—A second track is to built on the four miles of the Concord & Portsmouth from Portsmouth to Greenland, N. H.

Delaware & Otsego.—There is a fair prospect of the early completion of this road to the Cooperstown Lake region in New York. A meeting of the directors of the company was held recently, and action taken to complete the road from the present terminus at Bloomville to Oneonta. The Ulster & Delaware River road will operate the road as soon as it is completed. The balance of the capital stock of the company is being paid in, and it is thought that the $125,000 needed to finish the line will soon be raised.

Delaware, Susquehanna & Schuylkill.—The contractors have 450 men at work on the construction of the main line and branches of this road in Luzerne County, Pa. About 29 miles of the road has been finished, but this includes several of the branches. The main line between Drifton and Gowen is 35½ miles long and extends through Eckley, Stockton, Hazleton and Tomhicken. The contractors are C. F. King and W. E. Howley & Co. There are seven iron bridges on the line, each about 70 ft. long. The grading is generally light, with maximum curves of nine degrees and maximum grades of 57 ft. to the mile.

Duluth, Mesabi & Northern.—Negotiations are pending for the sale, to an English syndicate, of the franchise and right of way of this road. together with some iron properties on the Mesabi range, for $3,000,000. M. B. Harrison, the Merritts and other Duluth capitalists are the promoters of this road, and are also interested in the iron mines in the Mesabi Mountains in northern Minnesota, which it would reach. The road would connect with the Duluth & Winnipeg, entering Duluth over the track of the latter, and would either use the Duluth & Winnipeg terminals or join with them in the ownership.

Elmira, Cortland & Northern.—The track of the road at a point between Swartwood and Van Ettenville, N. Y., is being elevated about 20 ft. to allow the main line of the Buffalo & Geneva to pass underneath. The elevation is being made for a distance of more than a mile.

Fincastle & Cloverdale.—Two miles of the grading remains to be completed on this road between Fincastle and Cloverdale, Va., on the Shenandoah Valley, seven miles altogether. Ties are being distributed, but there is only a small force employed on the work, and it is not likely that the road will be ready for operation for more than a month.

Findlay Belt.—The grading is now in progress at Findlay, O., but the contractors are not showing any haste in completing the work. At present about six miles has been graded around Findlay and the rails laid for a short distance. Little other work has been done, but it is stated that the tracklaying will be resumed in a few weeks, and completed without further delay. The maximum grades are 65 ft. to the mile, and the maximum curves 10 degrees.

Findlay, Ft. Wayne & Western.—Grading may be resumed this month on the western extension and it is expected to complete before winter about nine miles from Huntstown, Ind., the junction with the Toledo, St. Louis & Kansas City road to Grover Hill, about 15 miles from the Ohio State line.

Georgetown & Granger.—The last two miles of this road near Granger, Tex., has not yet been graded, but the contractor expects to complete the work in a few days. The line now being built is 10 miles long between Georgetown and Granger, Tex. Surveys have been made from the latter point toward Austin and a subscription is being raised in the latter city to purchase the right of way.

Great Northern.—The following is the substance of a dispatch from Great Falls, Mont.: "Surveyors of the Pacific extension have made the discovery that the main divide of the Rockies is only 5,200 ft. above the sea level, instead of 5,500 ft., as shown in the old maps. Over 5,000 men are employed in grading and tracklaying, and it is expected there will be no cessation of work this winter. Sixty miles of grade is ready for the track west of the present terminus."

The company has notified the contractors to stop work on the branch road that is being built through Red Falls, Minn. The work will remain at a standstill until the company can secure the right of way at reasonable figures.

Great Northwest Central.—Within the next month trains will be running on this road in Manitoba. Section men began work last week to repair the road for traffic. Locomotives and rolling stock have been ordered and a train service will be inaugurated as soon as possible. It was the intention of the company to have the terminus at Brandon, Man., but as that point is regarded as inconvenient for immediate purposes, the line will be extended from its present intersection of the Canadian Pacific to Charter, a distance of three miles. Mr. Forest, who has been appointed Chief Engineer of the road, is now out on the line superintending the work.

Iron Range & Huron Bay.—Sanford Keeler, the General Superintendent of this line, states that the heavy rock work in the Huron Mountains on which the contractors are now working will take until next May to finish. He expects that all the other construction work will be completed by that time, so that the road can be opened for operation in that month. The grading has been nearly finished on the other portions of the line, but no track has yet been laid. The route of the road has already been described. It extends from Huron Bay through Arvon, in Baraga County, and through Michigamma to Champion, in Marquette County. The surveys in the Huron Range have only been made to Champion, but it is proposed to run the line to a number of other iron mines in the mountains. There are no iron bridges, but the maximum grades are five per cent. and the maximum curvature 10 degrees.

Kansas City, Watkins & Gulf.—Kennedy & Stone, of Topeka, Kan., who have the contract for track-laying and bridging on this road from Lake Charles north to Alexandria, La., have been recently awarded the contract for completing the grading between Alexandria and Babb's Bridge, a distance of 27 miles. When the Prosser-Ware Construction Co., of St. Louis, suspended work some weeks ago, the first seven miles to Spring Creek had not been graded. This section has been sublet to Ward & Courtney. The contractors have already commenced work at Spring Creek, and will push the work to completion.

Lake Erie & Detroit River.—Last week engineers began a new survey for the extension of the road from Leamington, Ont., east. Some time ago a survey was made passing through Blenheim and Wheatley, but as these two places refused to vote in favor of a bonus to the road, the company has authorized a survey directly from Leamington to Ridgetown. This will leave Wheatley and Blenheim four miles to the south. As soon as the survey is complete the construction will, it is reported, be commenced.

Maine Shore Line.—The survey just made on the eastern division between Eastport and Calais, Me., gives a road between the two towns 27⅛ miles long. The route into Eastport is difficult, on account of the irregular coast line, and two surveys have been made for it.

Mississippi River & Bonne Terre.—The grading on the 14-mile extension between Bonne Terre and Doe Run, Mo., was completed last week and track is now being laid. It is expected that trains will be running on the new line by Nov. 15.

Montreal & Ottawa.—The agreement between this road and the Grand Trunk has been rescinded, and it is the intention of the directors to complete the road independently of either of the Canadian trunk lines. A vigorous policy for the construction has been agreed upon, and as the financial difficulties in the way have been overcome construction is to be rapidly pushed ahead and the section of the road between Hawkesbury and Rigaud completed this fall.

Nashville, Chattanooga & St. Louis.—The tracklaying has been resumed by Contractor Nichols on the last few miles of the Tennessee and Coosa extension to the Tennessee River, near Guntersville, Ala. The grading is completed from the present end of the track to Guntersville, with the exception of a small gap. The cut at Harrison's Gap is now being completed.

Norfolk & Western.—The prospect now is that the Ohio River bridge at Ceredo, W. Va., and the Elk Horn tunnel and the extension from Elkhorn to the Ohio River will be completed and ready for trains by Feb. 1. The bridge will probably be completed before the cold weather. The four spans are all up and nearly ready for use, and work on the steel viaduct approaches each nearly a mile in length, is being pushed with all possible haste. There is considerable track to lay on the extension yet, but it is thought it can be finished by the time the tunnel on Twelve Pole River is done. The tunnel work is necessarily slow, and it will probably delay the completion of the line a little.

Northern Pacific.—The tracklaying on the extension to Ocosta on Grays Harbor is nearing completion, and if the ballasting is not delayed the company will probably run trains over the line early in December. The entire road has been graded and the track is to be laid on a short distance near Ocosta. The bridge of the Chehalis River is not yet finished, and the opening of the line will depend largely on the completion of that bridge.

A survey will probably be made soon for a short branch to the north side of Grays Harbor and to the town of Aberdeen, beginning at a point on the branch near the Chehalis River, where the line swerves to the south. This branch has been graded for about two miles, but the remainder of the right of way has not been secured. The town has now undertaken to obtain the right of way and construct a station if the branch is completed to Aberdeen.

On the South Bend extension a cut about 12 miles west of Chehalis is delaying the tracklaying. The work will probably be resumed this week, and can be continued for six miles, where a bridge is being erected. Beyond the bridge the grade is ready for the track as far as Pe Ell. This will be the headquarters of the construction forces until the road is completed to South Bend on the Pacific.

The construction of a branch road to connect the two new lines of this company now building in western Washington to the Pacific Coast, is said to have been decided upon. The route of the line has not yet been definitely fixed upon, but it is believed that the road will be built from South Bend to Ocosta, along the Pacific Coast.

Ottawa & Gatineau Valley.—The final inspection of this Quebec road was made last week by the Government engineer over the first 29 miles north of Ottawa, which will be opened immediately for traffic.

Philadelphia Northeastern Elevated.—President F. B. Esler states that the construction of this road will be commenced this month on the section from Market street to Amber street. The length of this section is 2½ miles. Work will begin near the intersection of Amber and Front streets, and will be continued south from that point along Front street to Market street. The road will probably be built from plans made by the Phœnix Bridge Co., the builders of a large portion of the New York elevated roads. The structure will be lighter than those roads. The construction will be lattice work, the minimum height to the rails being 14 ft. above the street, the width varying with the street. The pillars will rest on a foundation 8 ft. deep. The company will have experiments made with electric motors before orders for locomotives are given out. The length will be five miles, including the road to Frankford and the branch to Jenkinstown. It will be double track, and the cost of construction is estimated at $500,000 a mile. The route of the elevated road, as provided for by an ordinance approved in June last, is as follows: A double track road from the county line at Cheltenham avenue to Butler and Mascher streets; on Mascher street to Tusculum, to Kensington avenue, on Kensigton avenue to Lehigh avenue, on Lehigh avenue to Amber street, on Amber street to Front street, and on Front street to Pollock street. Also, a branch from Lehigh avenue to Emerald street, and northeastward to Erie avenue; thence over private property to Frankford avenue, near Butler street; thence on Frankford avenue to Margaretta street; over private property to Cedar street, to Bridge street; and over private property to Tacony and Holmesburg.

Richmond & Danville.—The Caraleigh branch at Raleigh, several times referred to, is only about two miles long and is practically a siding beginning at a point on the North Carolina road, about one mile southeast of Raleigh, N. C., and extending to the Carleigh Mills, south of Raleigh.

St. Louis Southwestern.—The company has closed a contract, and work is now in progress for the building of two miles of new track from the present junction with the Little Rock & Memphis Railroad east of Argenta, to enable the trains to run into the Union Station at Little Rock, Ark.

Saltair.—The preliminary surveys have been made for this line between Salt Lake City and Saltair Beach, which is situated on Great Salt Lake, 15 miles south of the city. The route surveyed is a tangent, and nearly level. The company has just been organized, and no contracts for construction work have yet been let. The capital stock is $150,000, and is all paid in. The estimated cost of building the line and equipping it is $132,000. Probably a 60-lb. rail will be laid, and it is proposed to extend the line west toward the Nevada state line. Matthew White, of Salt Lake City, is General Manager.

San Antonio & Aransas Pass.—A dispatch from Waco, Tex., says that the protracted struggle between Gurley, Ross & Gurley, the contractors, and the Aransas Pass receivers has ended at last. A compromise has been reached and the short gap Cameron and Lott, Tex., will be built, completing the West Point division of the road.

Sandusky, Columbus, Lake Erie & Southern.—The track has been laid for about 10 miles south of Sandusky, O., and at present half a mile of track is being laid daily. This work can be continued without interruption as far as Bellevue, the end of the graded road. The grading however is going on south of the latter town. The road is to extend through Bloomville and Bucyrus to Columbus. The prospect of a lease to the Columbus, Shawnee & Hocking may give the line an impetus which will carry it through.

Skowhegan & Norridgewock.—A working survey for the line between Norridgewock and Skowhegan, Me., will be commenced this week by an engineer of the Maine Central. The directors of that road have recently renewed their proposition made a year ago to the new company to guarantee its four per cent. bonds to the amount of $75,000. The directors have finally decided to accept that proposition and probably the contract for building the line will be let this fall.

Southern Pacific.—Work has been commenced on the change in the route into South San Francisco by the Coast Division, and the old entrance via Valencia street will be abandoned, at least by the through trains. The new route will be to the right of the San Bruno hills, and will branch off from the main line below Baden, in San Mateo County. The new track is already being laid along the level land, but before the road can be completed two large tunnels must be excavated through the intervening hills. The terminus will still be at Fourth and Townsend streets, as now. The road may not be entirely abandoned, but used for accommodation trains between San Francisco and Colma. The grade over the present road is very heavy, and helping engines are required near the city.

Tacoma & Eastern.—V. G. Bogue, late Chief Engineer of the Union Pacific, recently made an examination of the right of way of this road near Tacoma, and to coal mines owned by the projectors. The road is to be about 40 miles long, extending from Tacoma in the direction of Mount Tacoma. The company controls valuable right of way into the city. It is stated that Mr. Bogue was acting for a syndicate which proposes to complete the road.

Tacoma, Edison & Puyallup.—Articles of incorporation were filed in the county auditors office of the Tacoma, Edison & Puyallup Railroad. The incorporators are: R. F. Raddebaugh, T. B. Wallace, George W. Byrd and S. F. Sahm, of Tacoma, Wash., and Frank O. Meeker, of Puyallup, Wash. The capital stock is fixed at $500,000. The new company is a consolidation

of the Tacoma & Puyallup and the Wapato & Park Belt Line.

Texas Trunk.—George W. Burkitt, a railroad contractor, of Palestine, Tex., has agreed to secure the right of way and a bonus for the extension of this line through Anderson County for the extension to Palestine, if the receivers decide to build the extension in that direction.

Tonawanda Valley & Cuba.—The litigation in which the road has been involved for the last dozen years, and which did not cease when an attempt was made to reorganize the company after the foreclosure sale last March, seems now to have been settled. The last deed in the transfer was filed last week and the appoval of the court is expected this week. The old project of changing the gauge from 3 ft. to standard has been revived and the officers expect to soon arrange to complete this work on the 30 miles between Attica and Sandusky, N. Y.

GENERAL RAILROAD NEWS.

Baltimore & Ohio.—The gross earnings for September were $2,303,853, an increase of $80,530 as compared with the same month of last year, and net earnings $814,087, a decrease of $20,131. For the year ending Sept. 30 the gross earnings were $24,510,798, an increase of $98,702 as compared with the previous fiscal year, and net $7,451,209, an increase of $5,983.

Brooklyn Elevated.—It has been decided to abandon about one mile of the old line of the Brooklyn Elevated, and after the stockholders' meeting on Nov. 10 the directors will apply to the State Railroad Commissioners for an order authorizing the company to discontinue the operation of this part of its road. The line which it is proposed to abandon extends from Grand and Myrtle avenue along Grand and Park avenues to Hudson avenue. It is duplicated by the line of the Union Elevated along Myrtle avenue, which was built before the consolidation with the Brooklyn Elevated, and is a block shorter and a straighter line.

Central Pacific.—The suit of the United States, complainant, against the Central Pacific Railroad, the Southern Pacific Co. and the Western Union Telegraph Co., has been set for hearing on Nov. 2, in the United States Circuit Court, sitting at Washington, D. C. In this suit the Government asks that the lease by which the Central Pacific assigned all its property to the Southern Pacific Co. be set aside and canceled; that a contract between the Central Pacific and the Western Union Telegraph Co. be also canceled, and that the Central Pacific be directed henceforth to operate its telegraph lines without discrimination.

Choctaw Coal & Railway Co.—In the United States Court at Ardmore, I. T., a suit for the appointment of a third receiver for the property of the company has been decided against the plaintiffs, who are unsecured local creditors. The court has ordered the receivers to pay all the floating indebtedness as soon as practicable, and to complete the Oklahoma extension, which is partly built between Fort Reno, on the Chicago, Rock Island & Pacific, and Oklahoma on the Atchison, Topeka & Santa Fe. It is understood that the bondholders have agreeed to advance the money for both these purposes.

Chicago & Alton.—The actual earnings for August, 1890, were $603,279, and for August, 1891, $791,531, an increase of $188,302. The estimated earnings for September are $755,400, an increase of $95,600 over the actual earnings for September, 1890. It is probable that the actual earnings for the month will be over $800,000.

Concord & Montreal.—Judge Clark, of Manchester, N. H., has granted a temporary injunction restraining the company from issuing $1,200,000 in new stock, authorized last week at the annual meeting.

Dansville & Mount Morris.—A certificate of the reorganization of the Erie & Genesee Valley Railroad in Livingston County, N. Y., and its incorporation as the Dansville & Mount Morris was filed at Albany this week. The plan of reorganization provides for $50,000 capital and the execution of a mortgage for $150,000 by the new corporation to secure that amount of bonds, payable in 40 years. The line has been operated by the New York, Lake Erie & Western, but the new company will probably operate it as an independent line.

Erie & Genesee Valley.—The New York, Lake Erie & Western this week ceased operating the Erie & Genesee Valley road, owing to differences between the former company and the security holders of the latter road regarding rental. The road is 12 miles long and extends from Dansville to Mount Morris, N. Y. The Erie has operated the line since 1872, the rental being $8,400, interest on bonds, but on the reorganization of the Erie in 1878 it held the lease to be void and has not paid the rental.

Kansas Central.—The Attorney-General of Kansas has filed a petition in the Supreme Court asking for a writ of mandamus to compel the Union Pacific to relay the Kansas City branch with steel rails before Jan. 1 next. The orders of the State Board of Railroad Commissioners to relay the road with new rails have been disregarded and the action taken by the Attorney-General is at the Commissioners' request to enforce obedience to the board's order.

Lake Erie & Western.—The company has executed a mortgage for $3,625,000 to the Central Trust Co., of New York. The deed covers 725 miles, and includes the roadbed and all other property appertaining to the lines. The company is to issue five per cent. bonds, dated June 30, 1891, and payable in 50 years, the bonds to be issued at a rate not to exceed $5,000 for each mile. The mortgage is subject to a first mortgage, dated February, 1887, made to the Central Trust Co. and A. L. Mason.

Mount McGregor.—At the referee's sale at Troy, N. Y., this week the railroad and property, including the Hotel Balmoral, near Saratoga, was sold to D. H. Fonda for W. J. Arkell, the principal owner, for $28,500, subject to mortgages aggregating over $50,000.

New Orleans & Southern.—A first mortgage for $250,000 has been authorized and will soon be issued. It is to secure an issue of five per cent. bonds, the proceeds to be used for various improvements and extensions. All the bonds have been subscribed by the stockholders of the old New Orleans & Gulf road.

New York, Pennsylvania & Ohio.—The annual report states that the earnings of the last year show a slight decrease, the gross earnings for the year being $7,100,000, or $180,000 less than last year. The physical condition of the road is greatly improved, and has enabled the company to handle a large amount of through business. Extensive improvements in the way of terminal facilities have been added, and the actual capacity of the iron-ore docks materially increased. Nearly every matter of difference between the companies and the lessor road has been adjusted to the entire satisfaction of both, and the best of feeling prevails.

Northern Pacific.—Judge Caldwell of the United States Circuit Court at Fargo, S. D., has rendered a decision giving the company a clear title to all lands within its land grant not known to contain mineral at the time of filing the map of location of the road. General Counsel McNaught says: "The Interior Department held that the company had no title to the indemnity lands, but the counties of the State of Dakota insisted that the company should pay taxes on these lands. The company then brought suit to enjoin the collection of taxes, and it is this suit which has just been decided. The decision follows the one made by Judge Sawyer, and holds that the Northern Pacific has title to all the odd numbered sections within the limits of its grant at the time of the filing of its map of the general route and not known to be more valuable for its minerals than for any other purpose at that date. A large percentage of its lands now known to be valuable for their minerals in Idaho and Montana were not known to contain such minerals at the time of filing the general map in 1872. It is said that the decision is worth from $15,000,000 to $20,000 000 to the railroad, although on the issue as to the taxation of lands, the pretext for bringing the suits, the decision is against the company.

Oregon Pacific.—The Circuit Court has ordered the sale of this road to pay the claims, amounting to $100,000, filed by the employés for unpaid wages. The attorney for the bondholders announced that he would file a petition for the removal of Receiver Hogg, accompanied by the assurance that all operating expenses and wages due employés would be paid, if the Court would appoint a new receiver satisfactory to bondholders. The matter was continued until November. The bondholders claim that Receiver Hogg obtained his appointment surreptitiously and there is much dissatisfaction with his management. The dispute over the manner and amount of the bond issues does not seem to be any nearer settlement than when a committee of the bondholders was appointed last year to investigate the subject.

Pacific Mail Steamship Co.—The company has decided to issue $3,000,000 six per cent. bonds to pay for the construction of new steamers for the China trade. The construction of the steamers and the issue of bonds, however, the officers of the company state, depends wholly upon the company's obtaining the contract for mail service under the new postal law. The company will need three new steamers on this line. The company has two new steamers now building, which will be finished by March 1, and two others rebuilding, which will be finished by May 1, and will be paid for entirely out of the earnings.

Pullman's Palace Car Co.—The stockholders authorized a 20 per cent. increase of the capital stock at the annual meeting in Chicago, Oct. 15. The directors offer this stock to shareholders for subscription until Nov. 17 at par to the extent of one fifth of their present stock. The directors state that the new stock has been issued to enable the company to extend the operation of the car lease plan, under which it is building a large amount of freight and passenger equipment. There is also a necessity for a large increase of the sleeping and parlor car equipment of this company to meet the steady growth of business, and especially the demands incident to the World's Fair in 1893. The company has increased its capital stock eight times in 12 years. The stock in 1879 was $6,000,000. It was increased to $8,000,000 in 1881, to $12,500,000 in 1882, to $13,269,000 in 1883, to $16,000,000 in 1884, to $20,000,000 in 1888 and to $25,000,000 in 1889. The surplus has increased until it was $16,750,000 last year. The annual report gives the following statistics: Earnings, $9,772,325: operating expenses, $3,569,681; proportions paid to other interests in sleeping car associations operated by the company, $1,008,324, and dividends, $2,000,000; total expenditures, $6,783.101. The surplus for the year was $2,989,223. The car lease warrants outstanding are $2,671,180. There have been built during the year 191 sleeping, parlor and dining cars, costing $3,079,693, an average of $16,124 for each car. Orders have been placed at the company's works for 51 Pullman cars, the estimated cost being about $16,500 each, or an aggregate of $841,500. The number of cars owned or controlled is 2,239, of which 1,965 are standard and 274 tourist or second class cars. The number of passengers carried during the year was 5,310,813; the number of miles run 186,829,836. During the previous year the number of passengers carried was 5,023,057, the number of miles run 177,033,116. The year just ended shows an increase of about six per cent., both in the number of passengers carried and miles run. The total mileage of railroads covered by contracts for the operation of the cars of this company is 124,557 miles.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, Oct. 21, 1891.

The Ohio & Mississippi has announced a rate of 21 cents per 100 lbs., on flour for export from East St. Louis to Baltimore, a reduction of four cents. If this carries with it the corn and grain rates, as is not improbable, it may tend to confirm rumors that have been current for some time that a deal was on foot via Baltimore as against Chicago.

During the encampment of the Grand Army at Detroit last August the Chicago, Milwaukee & St. Paul desiring to make excursion rates from Des Moines, Ia., in connection with the Des Moines & Northern, requested permission of Chairman Finley to meet the rates of the Chicago, St. Paul & Kansas City line; this was granted and the C. M. & St. P. secured a considerable slice of the business. Later it filed a complaint against the Chicago, St. Paul & Kansas City for violation of agreement in making lower rates than were authorized by the association. In deciding the case the chairman stated that he was satisfied that under the agreement as hitherto interpreted the Chicago, Milwaukee & St. Paul had no right to participate in the business in question and dismissed the case. The road appealed it, and it is yet to be heard. Now the St. Paul & Kansas City has demanded from the C., M. & St. P. $2,053, being the revenue on the business secured by the latter. The Chairman rules that the St. Paul & Kansas City is barred by the association statute of limitation from having this demand considered, and suggests that if this is not satisfactory the road can appeal to arbitration.

The Santa Fe having reduced passenger rates from Kansas City to Washington via Chicago to $26.25 first class and $23 second class, to meet the competition of the Kansas City, Ft. Scott & Memphis, the rate has been made applicable by all the Kansas City-Chicago lines.

The Commissioners of the Western Traffic Association have rendered a decision on the application of the Chicago, Rock Island & Pacific for relief in respect to proportional rates between Chicago and lower Mississippi River points applicable to traffic to and from Missouri, Kansas, Nebraska, Colorado and Indian Territory. The road alleged that inequalities were created by a certain division sheet No. 64 issued by joint agent S. P. Brown. This division sheet is ordered canceled by Western Traffic Association lines. The Commissioners take occasion to state that in their opinion the printing and circulation of division sheets of this kind is liable to lead to abuses, no matter how carefully the subject may be guarded; and they therefore recommend that this freight be billed on through way-bills, thereby doing away with the necessity for the printing and circulation of division sheets.

There is considerable uneasiness in central traffic circles about grain rates, and charges are being made that things are not just as they should be in all quarters. As usual, however, it is impossible to find the "colored gentleman in the wood pile."

Traffic Notes.

Twenty-six cars of raisins were shipped eastward from Fresno, Cal., last week in a single train.

The Illinois Central has put on solid through night passenger trains between Chicago and St. Louis, via Vandalia.

A negro has been fined $25 at Belton, Tex., for insisting on riding in the white people's car on the Missouri, Kansas & Texas.

The merchants' organization at San Francisco, recently mentioned, is called the Traffic Association of the State of California. It was formally established last week.

A Pittsburgh paper states that ticket scalping is specially brisk in that city at present. Pittsburgh, it will be remembered, is in a state which, like Illinois, forbids the sale of tickets except at authorized offices.

A refrigerator car of the Eastman Car Heater Co. recently made a trip from Sioux City, Ia., to Galveston, Tex., in eight days with a single charging of ice. The car contained 140 quarters of beef, and less than two tons of ice was consumed.

The Southeastern Mississippi Valley Association, which was formed some months ago to control traffic south of the Ohio, east of the Mississippi and west of the territory of the Southern Railway and Steamship Association, is to be disbanded.

The Federal courts have declared the rules adopted by the North Dakota Railroad Commissioners, under the new elevator law, so far as they relate to the stopping of cars at the borders of the state for the inspection of grain, to be illegal. In consequence of this decision the state officials are not making any effort to enforce the law as far as it relates to stopping cars for the inspection of grain.

The Chicago, Milwaukee & St. Paul has placed on sale 10-ride tickets between St. Paul and Minneapolis for $1.50 each, equal to 1½ cents a mile. It is said that the number of trains between the two cities will be increased. Reports a few months ago were to the effect that the newly established electric street car line had taken away a considerable share of the passenger traffic between these two cities.

The railroad commissioners of Georgia have caused four complaints against roads of that state to be lodged with the Interstate Commerce Commission, the charges being based on inequitable interstate rates discovered by the commission in its investigations of the tariffs of the roads. All the cases represent complaints made by cities and towns alleging violations of the Fourth Section of the Interstate Commerce law.

Traffic through the Sault Ste. Marie Canal was completely blocked from the morning of Oct. 10 to the morning of the 16th, by the sinking of a vessel loaded with 60,000 bushels of wheat, which collided with another vessel at the St. George Flats. Government officers quickly secured a number of dredges and made a new channel around the sunken steamer. Nearly 200 vessels were ready to pass through when the blockade was raised.

The Pacific Mail Traffic Subsidy.

A meeting of the Transcontinental Association was held in New York this week, the principal subject being the apportionment of the sum to be paid the Pacific Mail Steamship Co. in connection with the traffic guarantee allowed it. The details are not given out, but the reporters gather that the subsidy paid the steamship company by the roads is apportioned as follows: Northern Pacific, 14 per cent.; Union Pacific, 26 per cent.; Atchison, 14 per cent.; Southern Pacific, 43. The Northern Pacific objects, however, to 14 per cent, because most of its transcontinental traffic is believed to be non-competitive, as regards the steamship route, and it is said that a new apportionment was agreed to, reducing the Northern Pacific's burden about one third. This settlement, however, is only for 90 days.

Eastbound Shipments.

The shipments of eastbound freight, not including live stock, from Chicago by all the lines for the week ending Oct. 17 amounted to 57,331 tons, against 60,025 tons during the preceding week, an increase of 2,694 tons, and against 67,363 tons during the corresponding week of 1890, a decrease of 10,032 tons. The proportions carried by each road were:

	Wk. to Oct. 17.		Wk. to Oct. 10.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	7,965	13.9	8,102	13.5
Wabash	4,088	7.1	3,776	6.3
Lake Shore & Michigan South.	8,536	14.9	9,552	15.9
Pitts., Ft. Wayne & Chicago	7,063	12.3	6,807	11.3
Pitts., Cin., Chicago & St. L	8,009	14.	9,709	16.2
Baltimore & Ohio	3,623	6.3	4,665	7.8
Chicago & Grand Trunk	4,970	8.7	3,739	6.2
New York, Chic. & St. Louis	5,169	9.	6,241	10.4
Chicago & Erie	7,908	13.8	7,431	12.4
Total	57,331	100.0	60,025	100.0

Of the above shipments 2,923 tons were flour, 20,548 tons grain, 1,677 tons millstuff, 4,974 tons cured meats, 8,085 tons dressed beef, 953 tons butter, 1,423 tons hides and 4,407 tons lumber. The three Vanderbilt lines carried 37.8 per cent. and the two Pennsylvania lines 26.3 per cent. The lake lines carried 82,679 tons, against 103,125 tons during the preceding week, a decrease of 20,446 tons.